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from CES

And five weird ones **p28**



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In-depth review of the £4 PC p60

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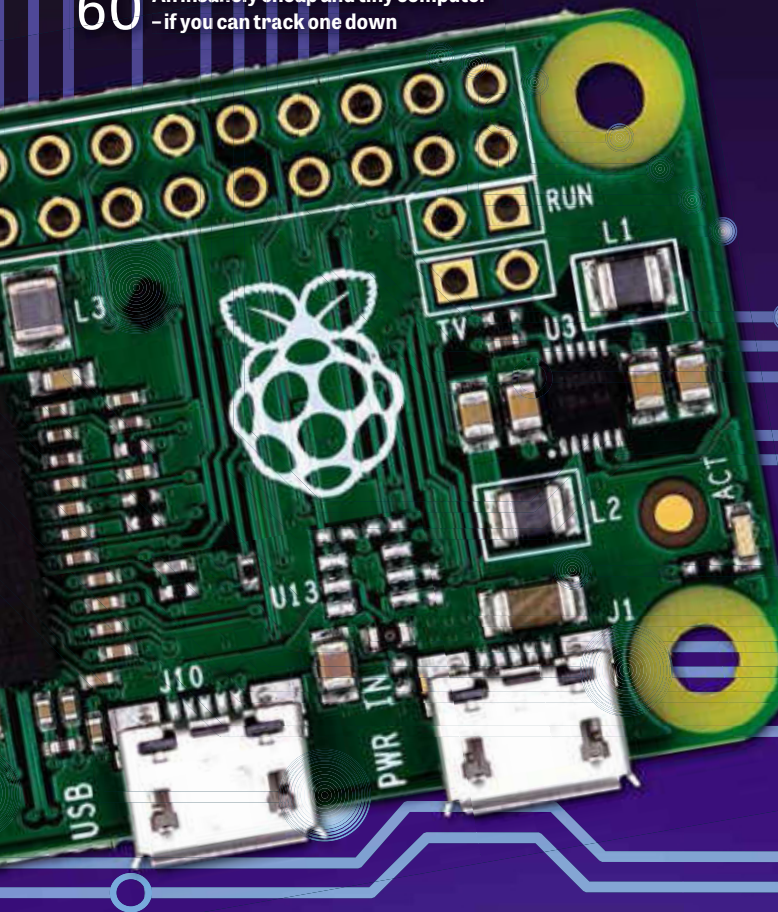
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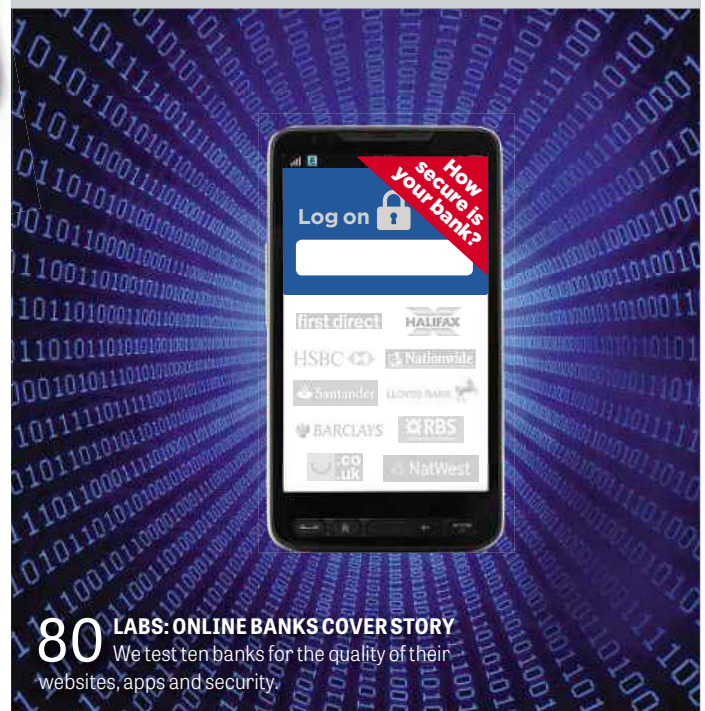
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Editor's letter

Stop being rude and read this

EXCUSE ME, BUT I hope you don't mind if I ask you to read to the end of this column? That would be terribly kind. It's about manners, you see, a topic inspired by the excellent Radio 4 series fronted by David Mitchell on modern manners. The second programme dealt with the internet and phones.

The latter is undoubtedly a scourge on society. I may not have the wit of Mr Mitchell, but is it too much to ask that you reach the end of my sentence before reaching into your pocket and checking your phone?

It's not my fault, I hear you cry. If I'm sitting in the pub and there's a vibration in my pocket, how on earth am I meant to resist the temptation to check it? Well, because it's rude. Not that I don't sympathise: last night I was in precisely that situation, having an in-depth conversation with a friend when my phone buzzed repeatedly. It took a surprising amount of willpower not to take it out, but (in that rarest of moments for male friends) we were talking about proper, heart-to-heart stuff. How crass to interrupt the conversation by flicking on my screen.

Most of the time, though, it isn't the buzzing that compels people to ignore friends who have bothered to meet up with them in person. The real problem is our fear that something more interesting is happening just over there. A trending tweet, a breaking piece of news, friends inviting us to a different social occasion just like the one we're currently attending. We have trained ourselves to be phone addicts, craving the next fix.

The problem is getting worse, too. Children are growing up unable to cope with boredom, one of the contributors to David Mitchell's programme pointed out, because the phone is always in their hand. An experiment with college

students showed that, after an average six minutes, they decided to give themselves an electric shock rather than sit alone in a room.

As if that wasn't enough, the silent buzz of watches pulls the attention of even the politest companion. Last week, I met up with a friend I hadn't seen for a year, so we had plenty to talk about, but within five minutes he'd sneaked three glances at his watch. It's not his fault, it's just the darn thing buzzing.

I'm not immune. I was guilty of it numerous times when doing a long-term test of the Basis Peak. Fortuitously, this died on me just before Christmas, leaving me bereft of watch but free of nagging distractions. Asics tells me to go for a run. Buzz. New text message. Buzz. Wycombe Wanderers have scored a goal. Buzz. Opponents have scored two. Buzz buzz. Meeting in 15 minutes. Buzz.

This meant I headed to CES watchless, and happily so. I had forgotten how liberating it was to be disconnected, especially during that glorious ten-hour period when my phone was in Flight mode. I'm not one for New Year's resolutions, but I decided there and then to cut down notifications to their absolute minimum.

In particular, I resolved, no more smartwatches for me. And then what happened? CES happened, that's what (see *our roundup* on p28). A Fitbit press event happened. And now, like the Pavlovian dog hearing the bell, I find myself desperate for the Fitbit Blaze. I promise, though, I'll keep all the notifications switched off.

Tim Danton
Editor-in-chief

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Sam Marshall
Giving users Office 365 without training is like installing a kitchen without also teaching cookery, argues guest columnist Sam Marshall on p117



Nicole Kobie
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Nik Rawlinson
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Barry Collins
If your laptop is crushed, who you gonna call? Most likely it's Kroll Ontrack. Barry speaks to its UK managing director in Profile on p20

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"I used a Psion 5mx to write a novel. I was halfway through when I dropped it, smashing the screen and losing all the data. Luckily, it wasn't a very good novel."

"I once used my phone's flash to shoot a rabbit away from a busy road. I told Jon Bray it should be a new PC Pro benchmark, but he seemed uninterested."

"One Christmas morning, I took my partner her morning tea with crumbly biscuit, using her present – an iPad mini – as the tray. She finished the biscuit before she realised what she had been eating and drinking from..."

"I use an ancient Toshiba Tecra to raise the height of my monitor. The phone book is too skinny these days."

"I used a laptop to trap a fly. It didn't work."



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Vinyl comes full circle

A journey through time: how music formats have changed [p12](#)

Five stories not to miss

Our quick-fire guide to the world of tech in the past month [p13](#)

PC Probe

Why Netflix's attempt to ban VPNs is doomed to fail [p14](#)

How computing giants must evolve to avoid a slow death

Stewart Mitchell discovers how, in a bid to remain relevant, the biggest players from the golden age of PCs are looking at everything from robots and drones to the Internet of Things

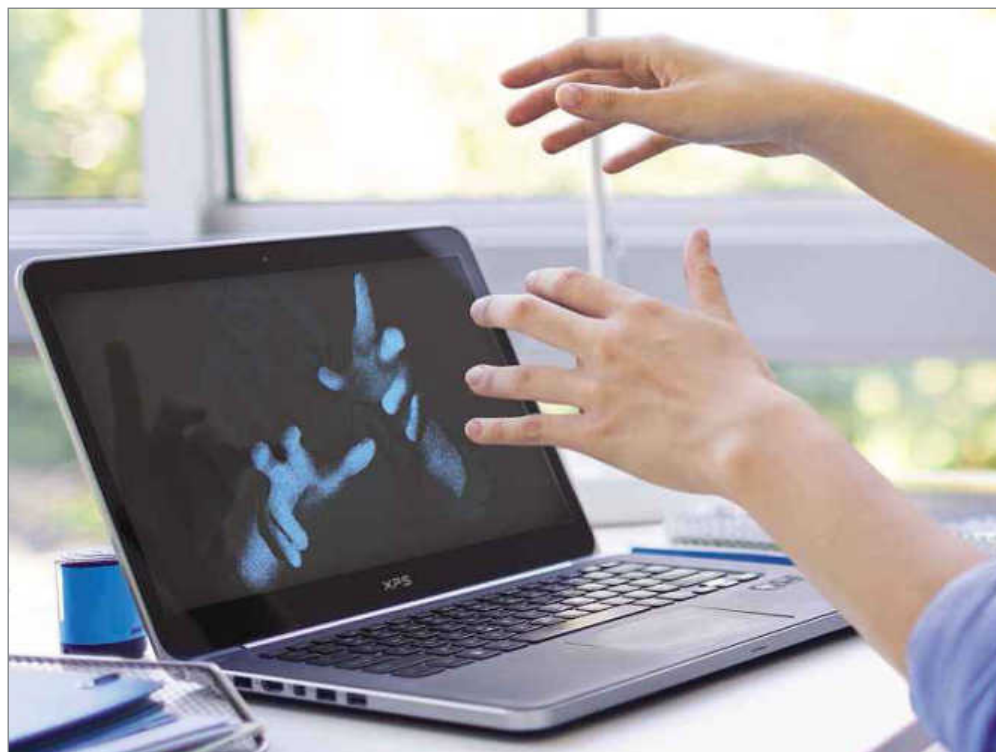
PC SALES FIGURES make for grim reading. According to figures from research group IDC, PC shipments fell by 10.8% in 2015 compared to 2014, dropping below 300 million units for the first time since 2008. Moreover, the long decline looks set to continue, despite potential upgrades to Windows 10. That's bad news for the companies that made their name during the golden age of the PC: Dell, Microsoft, Intel and others.

As the PC continues to dwindle, these companies are frantically looking for new areas to move into, or ways to enhance their current line-ups. "PC innovation is at an all-time high, but there's no getting away from the fact that consumer engagement has shifted to mobile and away from the PC, and even tablet," explained Geoff Blaber, a software analyst with research firm CCS Insight. "Diversification is critical for component suppliers and manufacturers."

Component manufacturers such as Intel and AMD will need to find new technology segments if they are to thrive, Blaber said, as simply supplying computer parts may no longer be enough for former manufacturing giants. "HP and Dell are both making the investments necessary to move beyond hardware to where value lies, in software and services," he said. "Doing so brings them into competition with behemoths such as IBM and Cisco, but diversification is critical. AMD is without doubt in an extremely challenging position in this post-PC transition."

■ Tech everywhere

Intel, meanwhile, has recognised that, while its chips can power today's PCs, tablets and smartphones, slower



Images: Left: INTEL

refresh cycles and market maturity means there may be more opportunity in the next big thing.

The company doesn't buy into the post-PC-era jargon, but does concede it's focusing on more-consumer-facing technology. "I see it as being a compute era, with PC a key part of it," Patrick Bliemer, Intel's managing director for northern Europe, told *PC Pro*. "However, the PC will continue to evolve, with innovations such as new form factors and moving to more natural interactions enabling a richer experience."

"Beyond that, we're seeing compute coming into all facets of our lives, which reflects what has been coined the fourth industrial

ABOVE PC firms such as Intel are branching into emerging tech, including 3D cameras and VR

revolution. This refers to compute disrupting how we work, live and play. To this point, we're also looking at the infrastructure that powers this revolution, from the networks to the servers enabling the cloud and data centres."

The company's prime exhibits at CES, for example, focused on drones, robots and wearable tech, while its latest advertising is focused squarely on lifestyle rather than clock speeds. Intel has bought drone manufacturer Yuneec; snapped up a stake in Airware, which produces operating systems for commercial drones; and acquired Ascending Technologies, which was already working with Intel on a crash-avoidance system.

In demonstrations, Intel has shown off how the systems can be combined to help drones dodge obstacles, but the technology could also be applied to other emerging devices. Part of its RealSense platform, for example, uses data from 3D cameras to improve spatial awareness and – complete with SDKs – could be used to develop virtual-reality tools, build smarter robots or collision-proof cars.

For Intel, platforms such as RealSense could be the drivers

“No-one knew the PC industry was going to be as big as it is today, whereas everyone knows IoT will be big”

for future domination, because while the potentially billions of new devices will all need processors, they’ll also need to communicate on a common platform.

Internet of Things

The potential land grab of standards and platforms is one reason why some big names are also circling the seemingly eternally emerging market of the Internet of Things. Chipmakers can see the potential of a connected world, but realise that the low-margin, low-power processors in connected devices may not be the biggest money spinners. That’s why ARM has built its broad mbed



ABOVE Intel has bought drone manufacturer Yuneec and has a share in Airware

BELOW 2015’s PC shipments fell by 10.8% compared to 2014

OS and TrustZone ecosystems, and Intel is also looking to control the IoT environment.

“Intel’s approach is to help with that deployment, and ease some of the issues using expertise we’ve acquired from the development of the PC industry, like standardisation. For example, Intel helped found USB as a way to connect peripherals easily and securely,” said Intel’s Bliemer, admitting the current state of IoT feels like the dawn of the computing age. “We are doing the same with IoT, working with standard groups and ensuring security end to end. I would point out, though, no-one knew the PC industry was going to be as big as it is today, whereas everyone knows IoT will be big in the future.”

However, there are no

guarantees the clout and experience of the big names from PC history will count for anything in the future. “They have an advantage if they make the right calls – most have made moves and they have the advantage of brand and cash to invest,” said Lionel Lamy, associate vice president at IDC. “The big guys are saying ‘we were dominant in the eighties or nineties, now we want to be part of the next wave’. They can do that, but they need to make the right calls and have the right tools and the right system. There’s no guarantee of success just because they were big or dominant at some point in time – no-one wants to be the Betamax of IoT.”

However, Intel and ARM aren’t the only computing companies hoping to dominate IoT. Microsoft has already built an IoT tool for its Azure cloud computing; Amazon Web Services has its own platform – everyone wants to be the equivalent of Windows in the PC era. The PC battle may be coming to an end, but the established giants haven’t finished slugging it out yet. ●



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Vinyl comes full circle for audiophiles

The LP is enjoying a Lazarus-like comeback, with a 64% jump in sales in 2015. There's even new hardware hitting the market, including a relaunch of the £4,000 Technics SL-1200 turntable. It seems audiophiles like to physically own media in quality formats, although the debate over which formats offer higher quality or richer sound rumbles on.

The 2.1m vinyl albums sold last year marked the LP's best figures in 21 years, during which

the CD has prospered and started to wane, while downloads and streaming have exploded.

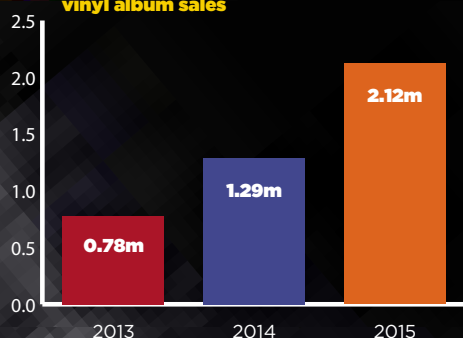
However, while audiophiles are leading a boom for vinyl, the LP remains niche and makes up a tiny slice of overall music sales. At the other end of the perceived quality spectrum, streaming music via services such as Spotify leapt 81% year on year, overtaking other digital music options such as downloading a digital copy of an album.

Vinyl: (don't) change the record

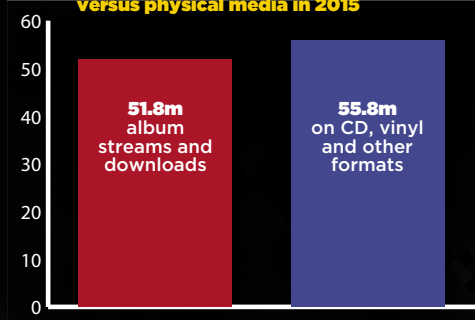
Here's how we've listened to music over the years.

1948 | Vinyl LP
Analogue vinyl born with a release of "The Voice Of Frank Sinatra" - little has fundamentally changed in the 68 years since.

Rebirth of vinyl album sales



Digital album delivery versus physical media in 2015



1982 | Compact disc

A digital optical format using two-channel 16-bit encoding at a 44.1kHz sampling rate per channel. Hardier than vinyl, but criticised for over production and artificial loudness.

1987 | Digital Audio Tape (DAT)

A digital cassette that was capable of recording at a higher 48kHz than CDs, but failed to take off outside professional and audiophile circles.

1992 | PCs and Waveform Audio Files

Developed by Microsoft and IBM, WAV is a raw, uncompressed standard. It uses the same audio coding format as CDs - able to store the same two-channel 16-bit audio sampled 44,100 times a second.

1995 | MP3

The format that started the online music revolution thanks to reduced storage and bandwidth requirements - at 128Kbits/sec, MP3 files are 90% smaller than their equivalent on CD.

1998 | First MP3 player

The MPMan F10 is launched with a capacity of 32MB.

2001 | FLAC (Free Lossless Audio Codec)

Launched as a lossless codec for audio quality to match CDs, but can only compress files by 10% to 20%. Some commercial services offer FLAC at 1,411Kbits/sec.

1999 | Windows Media Audio

Microsoft's attempt at MP3, WMA includes several codecs ranging in quality and can sample at 48kHz.

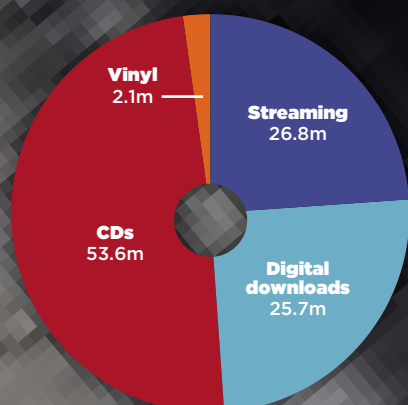
2004 | Apple Lossless

Originally restricted to Apple, but later made open source, ALAC supports up to eight channels of audio with a maximum sample rate of 384kHz.

2016 | Vinyl rebooted

Vinyl still in business and growing. Arguments over bit-rate equivalent, for comparison with digital music, range between 400Kbits/sec and 1,000Kbits/sec.

Album sales by type in 2015



Five stories not to miss

1 Microsoft calls time on ageing Internet Explorers



Microsoft has ended support for several versions of Internet Explorer as it continues to push users towards the latest version.

January marked the final update for outdated versions of

Internet Explorer, although which options remain available to end users depends on their installed version of Windows. Only the latest compatible version for each OS will be supported – people using Windows Vista will be able to patch Internet Explorer 9, while Windows 7 and Windows 8.1 users only have Internet Explorer 11 as a supported Microsoft browser.

The company is also ending support for Windows 8; security updates will only be available for users that have upgraded to 8.1.



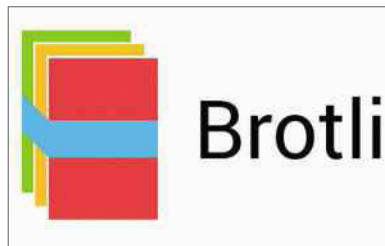
2 Employers can read your personal chat messages, court rules

Employers are within their rights to access private messages sent via chat or webmail accounts on company computers on

company time, according to European Court of Human Rights judges.

Although work emails have long been considered fair game for employers, a recent case highlights that bosses can delve into personal chat or webmail accounts – provided staff were using the accounts during work time.

The case was brought forward after a Romanian engineer was fired for using Yahoo Messenger for both work and private communications on company time. The engineer argued the company had violated his right to confidential correspondence, but the European judges said it was “reasonable that an employer would want to verify that employees were completing their professional tasks during working hours”.



3 Chrome browser's speed boosted by 26%

Google is to roll out a new compression technology for its Chrome browser, with the company boasting the new algorithm will make surfing 26% faster.

The company says it will use a new “Brotli” algorithm to compress data such as fonts and other page elements that can slow web traffic. The new algorithm will replace the two-year-old Zopfli algorithm to cut data transfer levels and battery usage. It could also be used in rival browsers.

“We hope that this format will be supported by major browsers in the near future, as the smaller compressed size would give additional benefits to mobile users, such as lower data transfer fees and reduced battery use,” said Zoltán Szabadka, software engineer for Google’s compression team.



4 Industry campaigns against US backdoors

Apple’s Tim Cook and experts from 42 countries have called on US officials to back down on their plans to force tech companies to include backdoors in encryption systems.

US authorities want access to encrypted messages that only security officials would be able to use, but privacy experts believe any backdoor would create weaknesses that could be exploited. “Users should have the option to use – and companies the option to provide – the strongest encryption available, including end-to-end encryption, without fear that governments will compel access,” reads the open letter on securetheinternet.org.

5 Google admits cars would have crashed without human intervention

Documents logging Google’s driverless cars have revealed that the auto-driving vehicles would have crashed 13 times in 14 months had a human not taken over the wheel, and that humans had to take the reins 341 times during the test period.

Of the 341 “disengagements”, 272 involved the software realising there was a problem and asking the driver to take over, while 69 incidents involved the driver needing to grab the wheel. Google said ten of the potential crashes were down to its technology, while the other three were down to other drivers.

The data was based on 424,331 driving miles and Google said the distance between issues had risen from 785 miles to 5,318 miles in the past year.



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PC Probe

Why Netflix's VPN clampdown is no blockbuster

NETFLIX

Film and TV streaming giant Netflix is caught between users and suppliers in its VPN blocking battle. **Stewart Mitchell** investigates

NETFLIX HAS BECOME the leading gateway to films and TV, but it's struggling to please both its viewers and the third-party film and TV studios that provide its content.

This perilous position of the go-between has been highlighted by the company's announcement that it plans to block VPN connections. The move could put paid to the trick used by many paying Netflix customers of accessing content that's not officially available in their territory.

Customers in the UK have long been able to log in through a US-facing VPN to fool Netflix into thinking the connection is coming from Springfield rather than Sheffield, and access the US' richer library.

"Some members use proxies or 'unblockers' to access titles available outside their territory," said David Fullagar, vice president of content delivery architecture at Netflix when announcing the clampdown. "To address this, we employ the same or similar measures other firms do. In coming weeks, those using proxies and unblockers will only be able to access the service in the country where they are."

It's fighting talk – especially given that subscribers merely want access to the same shows available to their foreign counterparts. It seems illogical to alienate a good slice of your client base.

"Our latest research shows that about 15% of Netflix users say they have used a VPN to access better entertainment content," Felim McGrath, senior trends analyst at GlobalWebIndex, told

PC Pro. "In the UK, this figure is 10%. These figures do not specifically relate to using a VPN over Netflix, but certainly illustrate the extent to which Netflix users are comfortable using VPNs to get better content."

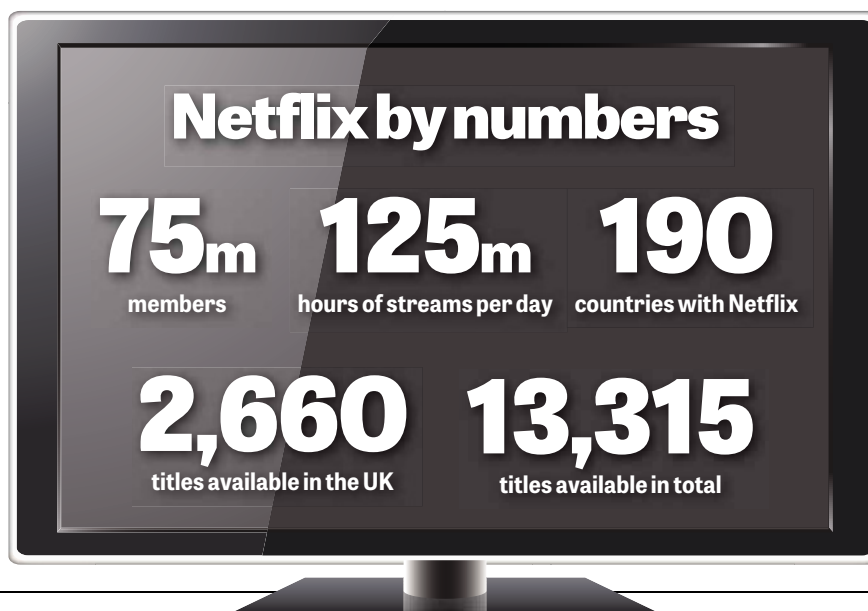
As more countries come online, the demand for access to more content is unlikely to diminish. One VPN company told us the use of VPNs had already increased since Netflix rolled out its service in another 130 countries in January.

■ Why make the effort?

The clampdown is seen as a response to pressure from the film industry, which has long maintained a rolling release and licensing model across multiple regions. Officially, the big studios remain tight-lipped, but an email published on WikiLeaks last year – stolen during the Sony hacks – shows how seriously the company takes Netflix's previous reluctance to enforce borders. "We have asked Netflix to take steps to more closely monitor circumvention websites,

and to restrict methods of payment to more clearly weed out subscribers signing up for the service illegally," wrote Sony Pictures' president of distribution, Keith Le Goy. "This is in effect another form of piracy – one semi-sanctioned by Netflix, since it is getting paid by subscribers in territories where Netflix does not have the rights to sell our content."

"Netflix gets to collect subscription revenues and inflate their sub count, which in turn boosts their stock on Wall Street, so they have every





motivation to continue, even if it is illegal.”

This puts Netflix in an awkward position. If it angers the studios, it has less content to sell. If it alienates subscribers, they’ll cancel their subscriptions.

Netflix, therefore, has to make a show of blocking extra-regional viewers. While the announcement might appease Hollywood, the VPN industry seems remarkably unconcerned. “We saw a higher volume of VPN usage after they rolled out their catalogue worldwide, and Hollywood must have knocked on the door and said ‘now, you have to do something’,” said Robert Knapp, CEO of VPN provider CyberGhost. “It will end up like the 2014 situation with Hulu. There was a big announcement about blocking VPNs, and they’ve failed to do that as you can still access Hulu through VPN services.”

Unless Netflix is willing to pump huge amounts of money into blocking its own customers, VPN operators will find technical workarounds. “If it really wants to start a VPN war of the same sort of level as people such as the Chinese government, which is really putting a lot of money and effort into keeping its firewalls safe (and it’s the same technical methodology), then they could start to cut off smaller VPN suppliers,” said Knapp.

“If it’s a small VPN provider with five or ten servers, it’s easy to lock them out. If you deal with big VPN providers, these methodologies get a bit harder because we have access to tens of thousands of IP addresses. We have an IP rotating system and an auto-detecting system to show whether our system is working with Hulu or Netflix.”

According to Knapp, most VPN providers would soon beat the blocks because “in a race between Netflix’s hare and thousands of tortoises on our side – we’re going to win that race all the time”.

Even Netflix itself remains unconvinced that its barricade will work. “People will always try and find ways

ABOVE The BBC says its hands are tied by agreements with its production companies

to get the content they want, no matter the technological barriers,” a spokesperson told us. “We recognise that, and that’s why we’re trying to offer our content to members globally at the exact same time catalogue.”



■ Rights row

A global catalogue is unlikely to happen soon, as one example of licensing from the BBC proves. UK Netflix customers may be annoyed that US subscribers often get access to BBC content on Netflix before it’s available on Netflix in the UK, but the corporation says its hands are tied. “It’s to do with the licence fee, and the BBC

“ People will always try to find ways to get the content they want, no matter the technological barriers in place ”

has an agreement with Pact – the producers alliance that represents the independent producers – to hold back the release of programmes into the secondary market [commercial rivals to the BBC, such as Netflix],” said Dan Phelan, head of communications for BBC Worldwide.

The BBC is, of course, just one cog in the global content machine, but the complications show how difficult agreeing licences can be – and why the VPN companies are confident the streaming market will continue to generate new clients trying to beat the system. ●

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The A-List

The ultimate guide to the very best products on the market today

LAPTOPS

Dell XPS 13

Late 2015 update, £1,149

dell.co.uk

We already loved the Dell XPS 13, but this update makes it irresistible. Skylake processors, superfast SSDs and Thunderbolt 3 all help it fly through tasks, and the design is as amazing as ever.

It's the ultraportable we've been waiting for.

REVIEW: pcpro.link/alxps13



SMARTPHONES

Samsung Galaxy S6

Android, 32GB, free phone, £25/mth, 24mths

uswitch.com

With the Galaxy S6, Samsung has finally created a phone as beautiful as it is capable. Superb performance, a nigh on perfect display and an astonishingly good camera provide the perfect foil to the most attractive Samsung handset yet.

REVIEW: pcpro.link/algals6



ALTERNATIVES

Apple MacBook Pro 13in with Retina display

The Force Touch keyboard makes the MacBook Pro even better. Note, though, we expect a new model soon. **From £999; apple.com/uk** **REVIEW:** pcpro.link/almacp15

Asus C201 Chromebook

It has weak points – the screen is okay rather than great – but the C201 is ideal for life on the move thanks to its outstanding 12-hour battery life. **£150; currys.co.uk** **REVIEW:** pcpro.link/alasusc201

Dell XPS 15

NEW ENTRY

Dell takes the XPS 13's beautiful design and applies it to this blisteringly quick 15.6in laptop. End result: the best 15in all-rounder yet. **£1,649; dell.co.uk** **REVIEW:** see p62

ALTERNATIVES

Google Nexus 5X

An ugly duckling but brilliant where it matters: speed, camera, and the latest Android 6 action. **£304; store.google.com** **REVIEW:** pcpro.link/alnexus5x

Sony Xperia Z5 Compact

If you can cope with a "mere" 4.6in screen, this speedy, slender phone has it all. **From free, £25/mth, 24mths; uswitch.com** **REVIEW:** pcpro.link/alsonyZ5

Apple iPhone 6s

Enthusiasts should upgrade for 3D Touch alone, with extra speed and durability as a bonus. **64GB, from £37, £39/mth, 24mths; uswitch.com** **REVIEW:** pcpro.link/alapple6s

TABLETS

Apple iPad Air 2

9.7in tablet, 64GB, £479

apple.com/uk

Even faster, even lighter and just as pretty as ever – the iPad Air 2 takes everything that made the original great and improves upon it. Updated cameras and the arrival of Touch ID are welcome upgrades. Its only real rival is the original 32GB iPad Air, now discounted to a tempting £359.

REVIEW: pcpro.link/alipair



ALTERNATIVES

Samsung Galaxy Tab S2 8in

Fast, slim and with a gorgeous 8in display, the Galaxy Tab S2 is as good as compact tablets get. **£333; handtec.co.uk** **REVIEW:** pcpro.link/alsgts2

Apple iPad Pro

The price is high, but you're getting so much more than a tablet. It's fast, beautiful and by far the most versatile iPad yet. **32GB, £679; apple.com/uk** **REVIEW:** pcpro.link/alipadpro

Apple iPad mini 2

A price drop due to the iPad mini 4's arrival makes this old-timer more attractive than ever. **16GB, £219; apple.com/uk** **REVIEW:** pcpro.link/almini2

PCs

Yoyotech Warbird RS10

Base unit, £600

yoyotech.co.uk

This PC offers serious power, thanks to an Intel Skylake Core i5 processor overclocked to 4.4GHz, 8GB of DDR4 RAM and a GTX 960 graphics card. Despite this power, it's quiet in use. An extra £100 will buy a 22in monitor and Zalman mouse/keyboard combo.

REVIEW: pcpro.link/alwarbird



ALTERNATIVES

Apple iMac 21.5in (2015)

As classy as ever, especially if you choose the 4K option. Just beware the bottom-end model. **From £899; apple.com/uk** **REVIEW:** pcpro.link/alimac2015

Apple iMac 27in with Retina 5K display

A new and revamped specification improves Apple's stunning all-in-one. **From £1,599; apple.com/uk** **REVIEW:** pcpro.link/alretina

Chillblast Fusion Krypton

Chillblast matches eye-catching design with buckets of speed – including a GTX 970 card. **£916; chillblast.com** **REVIEW:** see issue 256, p62

MONITORS

Asus PB287Q

Premium monitor, £370
dabs.com

Not so long ago, a 4K display for less than £500 was unimaginable. Asus delivers exactly that: a razor-sharp image on a 28in panel at a very reasonable price.
REVIEW: pcpro.link/alpb287q



Eizo ColorEdge CS240

Eizo ticks almost every box with the 24.1in, 1,920 x 1,200 ColorEdge CS240. With a highly colour-accurate IPS screen, it's the first truly professional-class monitor we've seen at anywhere near this price.
£444; wexphotographic.com
REVIEW: pcpro.link/alcs240

AOC Q2770Pqu

A feature-packed, 27in 2,560 x 1,440 display offering a huge workspace, an adjustable stand, a four-port USB hub and a three-year warranty. Super PLS technology gives great viewing angles too. At this price, it's a steal. £310; dabs.com
REVIEW: pcpro.link/alq2770

PRINTERS

Canon Pixma MG6450

All-in-one inkjet printer, £113
printerbase.co.uk

The MG6450 inherits its predecessor's status as *PC Pro*'s favourite inkjet all-in-one, offering high-quality output at a very reasonable price.
REVIEW: pcpro.link/almg6450



Canon Pixma iP8750

Canon's mid-range inkjet is ideal for anyone with a fancy for prints larger than the usual A4. It can print photos at up to A3+ in size, and its six-ink cartridges produce immaculate photographs, yet the price isn't extortionate. £200; currys.co.uk
REVIEW: pcpro.link/alip8750

Epson Expression Photo XP-950

Epson's high-end inkjet all-in-one is a fantastic all-rounder for the enthusiast photographer. It combines high-quality prints with a decent scanner, a great touch interface and the ability to output photos at up to A3 in size. £240; parkcameras.com
REVIEW: pcpro.link/alxp950

ROUTERS

Netgear Nighthawk X4S

802.11ac router, £270
broadbandbuyer.co.uk

In return for that staggering price, you're getting top-end performance, today and in the future – thanks to support for multi-user MIMO. Bags of advanced features only add to its attractions.
REVIEW: see issue 256, p86



Synology RT1900ac

Until now, Synology was probably best known for its NAS drives, but this 802.11ac router suggests it may become a major player here too. Not only fast, easy to use and packed with features, it also comes at a price that undercuts rivals by up to £50. £115; synology.com/uk
REVIEW: see issue 256, p87

DrayTek Vigor 2860Ln

NEW ENTRY
A brilliant router for businesses that demand excellent security features, while its VPN support is second to none – the price includes support for 32 IPsec VPN tunnels. It's worth every penny. £349 exc VAT; broadbandbuyer.com
REVIEW: see p95

HOME NETWORKING

Synology DiskStation DS215+

Network-attached storage, £257
amazon.co.uk

A versatile dual-bay NAS with great support for cloud services, dual USB 3 ports and our favourite web-based management interface. It's speedy and packs a lot into a compact unit.
REVIEW: pcpro.link/alds215plus



Qnap TS-453mini

Superb performance and a decent range of media and server features – including an HDMI output – make this four-bay NAS drive a great choice for both home and business. £326; ebuyer.com
REVIEW: pcpro.link/alts453mini

Google Chromecast 2

NEW ENTRY
Google's TV streaming device has been improved, finally adding support for 5GHz Wi-Fi. At only £30, it's a no-brainer for anyone looking to beam video from their Android device to their TV. £30; play.google.com
REVIEW: pcpro.link/alccast2

WEARABLES

Huawei Watch

Smartwatch, £289
huawei.com/uk

Android watches are gaining in number and class, as this excellent debutant from Huawei shows. Its super-bright AMOLED display is the star turn, but it's backed up by classy touches throughout.
REVIEW: pcpro.link/alhuaweiw



Apple Watch Sport

The slickest smartwatch experience there is, thanks partly to the unique scroll-wheel interface and advanced haptic features. The weakness is battery life – expect to charge it every night – and even the low-end Sport model doesn't come cheap. £299; apple.com/uk
REVIEW: pcpro.link/alapplew

Pebble Time

A fun, practical watch that, unlike so many rivals, works with both Android and iOS. App support is comparatively limited, but all the fundamentals are covered, and the colour e-paper screen helps the Time achieve five days of battery life. £180; firebox.com
REVIEW: pcpro.link/alpebble

SECURITY SOFTWARE

Kaspersky Total Security Multi-Device

Perfect protection scores and lots of extra features make Kaspersky Total Security fantastic value. **3 PCs/1yr, £30; store.pcpro.co.uk**
REVIEW: see issue 257, p85



Avast Free Antivirus 2016

Avast Free Antivirus 2016 can't match paid-for suites for virus detection, but it's still a strong performer with some nifty features. The pick of the free crop. **Free; avast.com**
REVIEW: see issue 257, p87

Eset Smart Security 9

A great choice for techie users, with excellent virus detection, but its ace card is anti-theft protection – which could save you a lot of money. **3 PCs/1yr, £50; shop.eset.co.uk**
REVIEW: see issue 257, p84

PRODUCTIVITY SOFTWARE

Microsoft Office 2016

We'll be honest: there's very little here for anyone upgrading from Office 2013. However, this is still the best office suite for professional. **From £120; office.microsoft.com**
REVIEW: pcpro.link/aloffice16



LibreOffice 5

The interface looks a little dated, and the lack of collaboration features is a shame. But interoperability with Word and Excel is better than ever, making this a fine upgrade. **Free; libreoffice.org**
REVIEW: pcpro.link/allibre

Scrivener

A brilliant package for serious writers: not only a word processor, but a tool that helps you organise your ideas and manage the process of composition from start to finish. **£29; literatureandlatte.com**
REVIEW: pcpro.link/alscrivener

CREATIVITY SOFTWARE

Adobe Creative Cloud

The licensing model won't suit everyone, but Adobe's suite of creative tools keeps getting better, covering everything from photo and video editing to web development. **Complete plan, £46/mth; adobe.com**
REVIEW: pcpro.link/alcc15



Adobe Photoshop Elements 14

Despite few new features, this is still the best home image-editing tool around. Consider subscribing to Lightroom and Photoshop proper instead, though. **£50; amazon.co.uk**
REVIEW: pcpro.link/alelem14

Steinberg Cubase Pro 8

A big bump in performance and a handful of UI improvements keep Cubase at the top of the audio-production tree. A worthwhile upgrade. **£320; dv247.com**
REVIEW: pcpro.link/alcubasepro8

SERVERS

HP ProLiant DL80 Gen9

Massive storage capacity combines with a high-speed Xeon E5-2600 v3 CPU and a scalable design to push this HP rack server to the top of the tree. The price is very reasonable as well. **£990 exc VAT; insight.com**
REVIEW: pcpro.link/alhpd80



HP ProLiant ML150 Gen9

HP's compact tower server packs in a huge range of high-end features, alongside impressive expansion capabilities so it can grow as your business does. A great buy. **£780 exc VAT; insight.com**
REVIEW: pcpro.link/alhplml150

STORAGE APPLIANCES

Qnap TVS-EC1280U-SAS-RP

Hungry for storage? Then take note of this 12-bay 2U NAS, to which you can connect up to eight disk shelves for a total of 140 drives. A 3.5GHz Xeon CPU speeds things along. **Diskless, £3,556 exc VAT; lambda-tek.com**
REVIEW: pcpro.link/alqnaptvs



Synology RackStation RS2416RP+

Built with speed and expansion in mind, this 2U rack NAS offers a feast of storage features and plenty of expansion potential. It's good value, despite not arriving with disks. **Diskless, £1,399 exc VAT; broadbandbuyer.co.uk**
REVIEW: pcpro.link/alsynology

SECURITY

Sophos SG 115w

A security appliance that gets it right on almost every level. Easy deployment, a huge range of features and a tempting price make this the perfect choice for SMBs. **With 1yr FullGuard, £809 exc VAT; sophos.com**
REVIEW: pcpro.link/alsophoss



Sophos Cloud

User-based policies and slick mobile support make this a top-class cloud solution. Performance is impressive, too. It's not the cheapest option, but it's a pleasure to use. **10 users, £510/yr exc VAT; sophos.com**
REVIEW: pcpro.link/alscloud

BUSINESS PRINTERS

Epson WorkForce Pro WF-5620DWF

Shatters the myth that inkjets are only for low-demand use, delivering fast output speeds, low running costs and tons of features. It prints at 20 pages per minute, and quality is perfectly acceptable – it can even print glossy photos. **£187 exc VAT; printerland.co.uk**
REVIEW: pcpro.link/alwf5620



HP Color LaserJet Enterprise M553x

HP's A4 colour laser offers excellent quality, fast printing and a low-power fuser that slashes the time to first page. A 10.9in touchscreen display makes it a delight to use too. **£618 exc VAT; printerland.co.uk**
REVIEW: pcpro.link/alhpm553x

BACKUP

Barracuda Backup Server 290

A beautifully simple appliance that brings together on-site and cloud backup. There's block-level deduplication, extensive support for Windows systems and applications, integral Exchange MLB, and simple deployment and management. **£4,446 exc VAT; barracuda.com**
REVIEW: pcpro.link/alserver290



DataFort Critical Care

DataFort's managed backup service takes care of everything, even bringing up virtual clones of your systems should disaster strike. Per-server pricing makes it cost-effective too. **One server, £350/mth exc VAT; datafort.com**
REVIEW: pcpro.link/aldatafort

NETWORK MANAGEMENT

Paessler PRTG Network Monitor 15

A network-management solution that's ideal for businesses on a tight budget. Paessler's PRTG Network Monitor 15 supports a wide range of devices, which are included in the price, and licensing is based purely on sensor count, so there are no hidden costs. An excellent way to keep tabs on what's going on in your network. **500 sensors, 1yr, £1,094 exc VAT; paessler.com**
REVIEW: pcpro.link/alprtgt15



SolarWinds Orion NPM 11.5

Offers excellent value for money, packing in a huge number of monitoring features as standard, including support for 802.11 wireless access points and virtual machines. **250 elements, £4,110 exc VAT; solarwinds.com**
REVIEW: pcpro.link/alnpm115

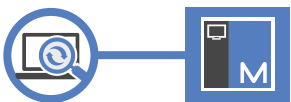
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Profile

BACKGROUND INFO ON INNOVATIVE BRITISH COMPANIES

Kroll Ontrack

Meet the company we hope you never need to call. If your laptop gets crushed with all your critical data on it, Kroll Ontrack could save the day



LEFT Kroll Ontrack can retrieve data from devices in even the most destitute state

KEY FACTS

IN A NUTSHELL

Kroll Ontrack claims to be the world's leading data recovery specialist. It rescues data for consumers, corporations, governments and the police. Its European headquarters are in the UK.

LOCATION Epsom in Surrey and 26 offices globally

FOUNDED 1972

STAFF 1,100 (worldwide)

WEBSITE
krollontrack.co.uk

It's fair to say the staff at Kroll Ontrack like a challenge. Whether it's the vital but grim task of recovering data from the black-box recorders on the Space Shuttle Columbia, or the recent retrieval of data from a Polish customer's 20-year-old Amiga 600, the clean rooms at Kroll Ontrack's premises see a huge variety of hardware – much of it in an appalling state.

However, it's not the fire-damaged or fractured hard disks that seem to give Phil Bridge, the managing director of Kroll Ontrack UK, cause for concern. In fact, you rather suspect Bridge and his engineers enjoy the task of piecing together smashed hard disk platters. "We always say 'don't assume it's irrecoverable'," Bridge told us.

Indeed, it's often not the physical recovery of the data that poses the biggest problem, but the format in which it's stored: the increasing use of encryption makes the recovery of data that bit harder for Bridge's team. But, as we discovered from our time with Bridge, Kroll Ontrack is a company that's used to working out ways of achieving the improbable.

■ Changing shape of storage

Kroll is renowned among the IT press for its regular media challenges. The company sends journalists new hard disks, invites them to fill the disks with their data, and then encourages said hacks to do their worst: drop the disks out of a third-floor window, dunk them in Coca-Cola or reverse over them in a Land Rover. The disks are returned to Kroll in sealed bags and, weeks later, the journalists are invited to its European headquarters in Epsom, Surrey and sit gobsmacked as staff pull up the photos and documents that were once stored on their seemingly obliterated drives.

If Kroll was to run the challenge again, it's as likely to send out an SSD or a phone as it is a hard disk, such is the evolving nature of the company's recovery business. Computer hard disk recovery is still a big part of Kroll's workload, but Bridge admits that more widespread use of cheap backup drives, and cloud backup in particular, is trimming demand for traditional types of data recovery.

Nevertheless, the shift to the cloud has opened new opportunities. "We're seeing much more data stored in the cloud, both for consumer and big-business data," said Bridge. "Ultimately, the cloud is still a storage device, it's just somewhere else."

Bridge says Kroll has good relationships with many of the cloud storage providers, which enables the company to recover data on their clients' behalf, either by remotely accessing the provider's servers or by physically getting their hands on the storage media. "It might be a question of the cloud provider ripping out a load of hard drives for us to work on locally," said Bridge, although in virtualised environments where multiple customers' data is stored on the same drives, that might not always be possible.

Moreover, Kroll works on behalf of the cloud providers themselves – even if some aren't always willing to accept the help. "We had a cloud company call us recently who had a serious data loss at their back-end," said Bridge. "They'd lost something like 3,000 customers' worth of data. We were able to recover the data for them, but it was going to be a massive job. The company actually decided to lean on its Ts&Cs and go back to its customers and say: 'your cloud storage is not a backup, it's just storage. If you haven't backed up your backup, that's your lookout'. They basically refused to recover their customers' data for them, and I suspect they're out of business now."

■ Obstacles to recovery

Kroll can retrieve data from devices in the most destitute state. The laptop pictured above right, for example, wasn't only melted by the office fire it was trapped in, but also doused by the sprinkler system. Kroll still managed to retrieve 100% of the data. Yet, even if every last 1 and 0 is rescued from a barbecued hard drive, there are still other obstacles to full recovery.

Data encryption is pervasive in business and now even on consumer devices. The iPhone encrypts user data and Apple claims it doesn't store the keys to decrypt it. Bridge says accessing encrypted data is "always a challenge", but not one that's insurmountable. "In some cases we need the

RIGHT This laptop was trapped in an office fire and soaked by the sprinklers, but Kroll Ontrack still managed to recover 100% of its data



manufacturers' assistance to get past some of this stuff," said Bridge. "In some cases, we've got tools that can do it themselves. In other cases, we just need to lean on the customer to provide us with decryption passwords and the like."

Is Bridge suggesting Kroll can circumvent encryption? "We don't like to go in via the backdoor and reverse-engineer anyone's stuff – we like to do it the correct way," Bridge insisted. "But it depends on a case-by-case basis."

A bigger problem is have-a-go heroes in the IT department. "So many devices come in to us after the world and his wife has had a crack at it. They've downloaded some software, they've tried to recover it themselves, it's gone to some back-street shop maybe. Sometimes they render what would have been recoverable irrecoverable."

Bridge claims that these botched rescue attempts are often a case of IT staff trying to cover up a mistake, such as botched backups. "It's not just embarrassing, it's their jobs on the line sometimes," he said. "It's not uncommon for us to speak to John from IT in the morning and call back in the afternoon and John no longer works there."

RIGHT Phil Bridge, managing director of Kroll Ontrack UK



It's not only technical ability that Kroll demands of its staff, but absolute discretion. It doesn't just recover highly sensitive data, it also offers to securely wipe data for clients. When those clients include the government, police and major corporations, any leak of sensitive data could be catastrophic for both the client and Kroll.

With recovery jobs often running to a tight deadline, the company's UK staff may be required to securely patch into data stored in a clean room in another country and complete a recovery started by their foreign colleagues. "We have a really good footprint across the globe that enables us to effectively follow the

sun and offer a 24/7, 365 service, minimising the time delays and the security concerns of any data crossing borders," said Bridge.

That requires Kroll to demonstrate to clients that its staff are trustworthy. "We have government-security-cleared engineers working on equipment, we're routinely audited by various different bodies, and we adhere to various different accreditations," said Bridge. "More than anything, we're a big international business and we've got our reputation on the line. We have to take it seriously because the reputational damage of a leak is incredibly high and something to be avoided at all costs."

That can involve drives being chaperoned to Kroll Ontrack's offices, where a dedicated, secure room is set up with no networked devices "so that anything we do in that room stays in that room". Any storage devices used in the recovery are also taken away, ensuring nothing gets left behind. "I've been here 20 years and I haven't found a situation yet that we couldn't accommodate," said Bridge.

Needless to say, these secure rooms don't form part of the tour, when journalists see how their hard disks have been reassembled. More's the pity... **BARRY COLLINS**

“When Kroll's clients include the government, police and corporations, any leak of sensitive data could be catastrophic”

■ Inquisitive minds

Solving these, often unique, data-recovery problems requires a special type of character. "I think that's one of the reasons why we have such a low [staff] turnover," said Bridge. "It's really enjoyable to

solve those problems that everyone thinks are impossible."

But there's no ready-made pool of trained graduates waiting to be picked up at careers fairs. "I don't believe there's a university degree in data-recovery techniques," said Bridge with a smile. That means Kroll searches for "technical minds" that the company can train in-house. "We send our new recruits around the world. We've got 27 offices and varying degrees of engineering skillsets in each. And then it's on-the-job [training] as you go. We have various different bands of engineer. They work their way through the different skillsets and operating systems and pretty much learn on the job from their colleagues."

What about you?

Do you work for a British technology company that could be profiled in PC Pro? If so, get in touch: profile@pcpro.co.uk



Viewpoints

PC Pro readers and experts give their views on the world of technology

Don't erase that file! Your future self will thank you for it

Our readiness to throw away old data is a destructive habit from a different era. It's time we stopped



Darien Graham-Smith is PC Pro's deputy editor. If you want to read the first draft of this column, he still has it.

I've had it with deleting files. Once upon a time, when floppy disks were genuinely floppy and came with a fixed capacity of 360KB, clearing out unwanted data was a necessary discipline. That's no longer the case: today you can buy a 4TB hard disk for £100. It's crazy that we're still so

cavalier about permanently destroying documents and spreadsheets once they outlive their perceived usefulness.

To an extent, it's psychological. As soon as you put a single file into the Windows Recycle Bin, the icon changes to show it overflowing with virtual papers. What would you do if your real bin looked like that? You'd empty it, and then give yourself a pat on the back. Microsoft encourages us to think of purging our old files as equally virtuous – even though in this case the “bin” is simply a list of files.

Then there's the fact that, while storage may be cheap and abundant, individual devices can easily be filled. More and more we're seeing Windows 10 tablets with a mere 32GB of onboard flash memory. Your free OneDrive storage gives you another 15GB on

top, but that's soon eaten up too. A merciless regime of deleting old files makes life easier in the short term.

In the long run, however, the loss is incalculable. Old PowerPoint assets or sales figures from 2007 can turn out to be tremendously valuable when you find you need to put together a presentation in a hurry, or to track the impact of a financial crash on your industry. Even if the data itself can't be reused, the metadata can tell a story – for example, letting you track how documents are accessed and updated over time. Back in 2004, Google launched Gmail with a similar sell: a generous storage allowance meant you could benefit from archiving old email rather than deleting it. A decade later, my mailbox is getting uncomfortably full, but the point stands.

On the personal front, what I'm most interested in is the items that gobble up space, namely photos and videos. Many of the things we capture at the time may seem mundane and pointless, but won't always remain so. A case in point: recently, I came across an old album of photos from when I was a very small child growing up in Hendon. The first few pages showed me happily playing in the garden or sitting on the carpet. The rest were blank. My

“Many of the things we capture at the time may seem mundane and pointless, but won't always remain so”

parents had evidently picked out the images where I was smiling, and ditched the rest.

I'd dearly love to see what else had been on that roll of film. The pictures that remain provide a unique personal connection to the way my family used to live in the 1970s. Almost more interesting than the people is the surrounding scenery, which at the time must have seemed entirely incidental. In the background of one picture I spotted my mother's old IBM golf ball typewriter, and instantly remembered the furious clacking it used to make as she typed. Who knows what memories ended up in the bin?

So I've determined that, henceforth, nothing I create shall be permanently deleted. If I take a dozen photos of our baby daughter, they're all going to be kept. Happily, that's now a pretty easy resolution to keep, thanks to Apple's Time Machine and

Windows' suspiciously similar File History. With both, you can continue to erase old files as you did before, to keep your desktop and document folders tidy, while recoverable copies are kept in perpetuity on your NAS drive or an external hard disk.

The rub is the “perpetuity” part. Forever is a long time, so you can anticipate that something will go wrong sooner or later. In my case, I chose to archive everything to a RAID5 NAS array, to protect my data against a hard disk crash. I hadn't considered the possibility that the enclosure itself would die. To cut a long story short, I ended up tracking down a four-bay USB enclosure, mounting the array from within a virtual Linux installation, and copying off the data by hand. It was a slow and complicated process, but what else can you do when the data is literally irreplaceable?

Like most cautionary tales, this one could have been avoided with a proper backup regime. However, once you start insisting that nothing is deleted, you can quickly end up with an inconvenient amount of data to protect. The initial upload to an online backup service could tie up your internet connection for weeks – assuming your ISP even allows you to transmit that many terabytes. And that's before we talk about

the price: most providers set their tariffs to encourage you to be selective about what you back up. If you want them to look after a terabyte of undifferentiated data, you can be easily looking at £100 a month. Why not go out and buy that 4TB USB hard disk, hook it up to your NAS drive and handle all your backups yourself?

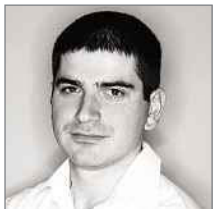
It's an approach that has its downsides. While remote backup leaves you vulnerable to the possibility that your provider might go out of business, local backup is susceptible to the rather more physical risks of fire, theft and flood. Disasters aside, there's also the inevitable fact that your NAS setup has now become two boxes, adding yet more cables to the rat's nest behind the sofa and supplementing the hum of your existing drives with a whole new chorus of whirring and clicking noises.

Yet, compared to the relentless hammering of a Selectric II typewriter rattling through the house, it's a small imposition indeed. If it means we can safely store our memories, and ensure our daughter remains in touch with her past as she grows up, then it's well worth it.

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We're not ready to share roads with self-driving cars

Smart cars will never be intelligent enough to fully co-exist on roads with human drivers



Barry Collins is a former editor of PC Pro. He failed his driving test six times – no onboard computer can handle him.

Who's gonna drive you home tonight? If The Cars re-released that classic song today, the answer would probably be Google, Ford or even Nvidia. At least that's what this year's CES would have us believe. Autonomous driving technology was one of the key themes of this year's show, with dozens

of companies determined to stop us getting behind the wheel and turn us into screen-prodding passengers instead.

You could feel the tension of an arms race between the various manufacturers, all determined to claim their spot in this seemingly inevitable market. There were the traditional car manufacturers – Ford, Chrysler, Mercedes – all desperate to prove they weren't being cowed by firms such as Google and Tesla muscling into their market.

Then there were component makers such as toughened glass vendor Corning, showing off prototypes of self-driving cars with no steering wheel, just touchscreen surfaces smothering the dashboard, central console, even the windscreen. "Where do you put the airbags to stop people smashing their head into the glass?" I asked the Corning rep. "It's just a prototype," he replied. "We'll figure that out." My self-driving eyebrows shot up.

Meanwhile, Nvidia has seemingly calculated there's limited mileage left in high-end PC graphics but an absolute fortune awaiting the company that cracks the self-driving car. Hence CEO Jen-Hsun Huang, disturbingly dressed like David Hasselhoff in *Knight Rider*, devoted Nvidia's entire keynote speech to a bewildering, jargon-doped presentation of the progress his company is making with its self-driving

system. As The Verge's live blog brilliantly noted, this "has three 'convolutional layers', which is an estimated ten convolutional layers fewer than this presentation".

There were a few startling moments in Huang's keynote that managed to skim past my jetlag and give cause for thought, though. The first was a visualisation of all the data being collected by a car's cameras and sensors as it drives down the road: millions of individual data points from the road surface, other cars, even leaves on surrounding trees, all being gathered, processed and identified in real-time. Little wonder then that it needs a "supercomputer" with the power "equivalent to 150 MacBook Pros" tucked in the boot of each car to process this data.

Moreover, consider the road video footage that Nvidia and other manufacturers use to train their supercomputers about real road conditions. Not just ploughing down motorways, but darting through crowded suburban roads, with the onboard computer automatically recognising pedestrians, cars and road signs. Teaching cars how to cope with these inner-city conditions was critical, Huang said, but hideously difficult. "In city driving, almost none of us are going in the same direction," he said. "People are sometimes following the rules, but mostly not. City driving is chaotic. It's complex. It's unpredictable."

And there's the rub with self-driving cars: us. Even if we're no longer behind the wheel of self-driving cars, we'll still be driving all the others. Think of all the visual cues we rely on to make progress down traffic-strewn, rush-hour roads: the flashing of headlights to let someone out of a side road, the waved hand to let someone cut across your lane when turning right. Will a smart car ever understand these? Will a safety-conscious computer gently edge out of a side road to force its way into a queue of traffic, or will it sit there for half an hour waiting for the safe gap it's programmed to wait for, infuriating the dozen drivers behind it, who will lose patience and cut in front of it?

And what about all the other scenarios that self-driving cars are ill-equipped to handle: following hand signals to park in fields at tourist attractions; bumping up the kerb to let an ambulance or fire engine get past down a narrow road; the game of bluff that occurs when all three entrances to a mini-roundabout are occupied and nobody has complete right of way. How does the smart car know how to drive onto the ramp at the garage? Which of the two unmarked spots on your drive to park in? Which the disabled parking spaces are at Tesco?

There's an almost endless list of scenarios that leaves me in little doubt that it's going to be impossible for autonomous cars to fully co-exist on roads with human drivers. They might cope in autonomous vehicle zones; I can see a self-driving lane on the motorway similar to the bus lanes we have now. But, as Huang said, our roads are chaotic – and if there's one thing computers definitely don't cope well with, it's chaos.

Dual-personality cars that can take control on motorways, dual carriageways and when parking, while providing the option of manual control, will win this market in the short to medium term. If Google, Nvidia and others want to take away steering wheels, the only thing they'll be driving is themselves out of the market.

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Moving broadband targets is an own goal

The cynical satellite subsidy is no way to meet broadband targets and, again, leaves out rural Britons



Nicole Kobie is PC Pro's Futures editor. She thinks the only Briton who should be relying on satellite broadband is Tim Peake.

It's easy to score when you keep moving the goal posts. That's long been the government's tactic when it comes to broadband targets, and it's still getting away with it.

Late last year, the government announced a plan to offer subsidies of around £350 for

satellite broadband to anyone stuck on a line slower than 2Mbps/sec. That pledge from the Department for Culture, Media and Sport (DCMS) may sound promising at first, but scrape an inch below the surface and it's clear how cynical the government and digital economy minister Ed Vaizey have become.

Back in 2010, the government promised that everyone in the UK would have access to connections of at least 2Mbps/sec by the end of 2012, later delaying it until 2015. At the beginning of December, with that goal still far out of sight, the DCMS announced the satellite subsidy, saying that an "estimated 300,000 properties across the UK will be able to make use of the new offer".

That means the government missed its own much-delayed target by at least 300,000 homes and businesses. However, that's not the message you'll hear from the DCMS: it's already moved onto a new goal, considering a universal service commitment (USC) of 10Mbps/sec by 2020, despite an abject failure to hit its previous target.

While many rural Britons will welcome the subsidy, satellite broadband simply isn't

“Our roads are chaotic – and if there's one thing that computers definitely don't cope well with, it's chaos”

a patch on a fixed-line connection. Over the past few years, satellite has improved, with prices falling, data caps loosening, and upstream speeds increasing thanks to the new Ka band. However, latency continues to be a problem. The signal must travel to space and back, and with ping rates of 600ms or longer, some streaming and VoIP services will struggle and real-time games are out of the question. Furthermore, satellite remains expensive, with many providers charging more than £350 for installation and hardware, meaning even those who qualify for the subsidy will likely pay more than the rest of us for a poorer connection. Simply put, nobody would choose satellite if fixed-line broadband was available.

There's no question such homes are difficult to reach. Most will likely be in extremely rural or otherwise difficult-to-serve areas – there's a reason they're not getting superfast coverage from BT or other ISPs. But that's the point of stepping in with public money, to fill such gaps, rather than as a one-off payment chucked at rural Britons in a cynical PR move.

If, back in 2010, the government had bothered to understand the difficulty of reaching its 2Mbps/sec target, it could have made a satellite subsidy available. Instead, hundreds of thousands of people have muddled along on dial-up grade connections, or paid for satellite installations themselves. Will the government be reimbursing everyone in the affected areas who paid the full price over the past five years? It really should.

Instead, it will dishonestly claim the UK has universal 2Mbps/sec broadband coverage, when it does not. And it will push ahead with a nonsense 10Mbps/sec USC target that we can expect will only be met by more goal-post shifting. Indeed, why not make it 20Mbps/sec this year? After all, satellite broadband already offers such speeds to anywhere with a view of the sky.

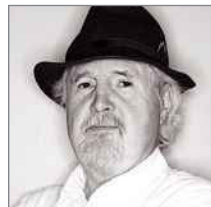
The worst part of the whole debacle is that it's not the first time the government has shifted its own goal posts: aside from the three-year deadline shift for the 2Mbps/sec USC, a pledge to cover 90% of the country with superfast broadband by the end of 2015 has slipped to 95% by 2017. And let's not forget that BT's own target of providing pure fibre connections to 25% of its rollout was also quietly shelved, without so much as a murmur from the government or the regulator Ofcom.

Pretending to hit broadband targets might look good on a press release or at election time, but it's an own goal when so many rural Britons continue to lose out.

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At last, I'm moving to the beat of the algorithym

Move aside Lloyd-Webber: music has a new creator, and it's all down to Python's programmatic charms



Dick Pountain is editor of PC Pro's Real World Computing section. He'd like to enter a smart fridge into Eurovision 2016.

You might have gathered by now that music ranks joint first, alongside photography and programming, among my favourite recreations. In fact, I combine all three in various ways, for example by applying filters to process my pictures, and by writing code to generate musical compositions. Around 15 years ago, I first became interested in computer composition, and was inspired to write my own MIDI interface in Turbo Pascal 4.

Rather than generating real-time music, this unit let me output MIDI files from Pascal programs, which could then be played in my sequencer of choice. I messed around for a while trying to do US-style minimalism (think Philip Glass), constructing complex fugues and phase-change tunes that no human could play. The results never really satisfied me, partly because General MIDI instruments sounded pretty rubbish through

“I messed around for a while trying to do US-style minimalism, constructing complex fugues that no human could play”

the sound cards of that era, and because I regularly ran up against shortage of memory problems, using what remained a more or less 16-bit development system.

I put the project aside for around ten years until another spurt of enthusiasm arrived (still using Turbo, but now running in a DOS box on a Pentium/Windows XP system). That time, I made tunes that were sufficiently convincing to put up on SoundCloud, but there were still nagging problems.

The structure of compiled Pascal confined me to writing short tunes. Using fixed-length strings and arrays as my main data structures made long-range structures, such as

successive movements on a varying theme, too cumbersome to achieve, but creating separate short movements and splicing them together by hand was cheating. My intention was to write single programs that generated pieces of recognisable music.

I finally shucked off my anachronistic addiction to Turbo Pascal and fell wildly for Ruby, but never did quite get around to rewriting my composing system. I then stopped again, until I remade acquaintance with the hitherto-spurned Python language. In order to get up to speed, I rewrote my venerable Poker program – first effort in Basic on Commodore Pet circa 1980; next in Delphi under Windows; last in Ruby circa 2002 – which translated with surprising ease into Python. Brimming with confidence, I got stuck into rewriting my music system.

I struggled at first because the kind of bare-metal-bit-twiddling (curse you MIDI variable-length quantity!) that's so easy in Turbo Pascal isn't obvious using Python's arbitrary-precision integers. Scanning the forums, I soon found a GNU-licensed library by Mark Conway Wirt that does exactly what my old TP one did, and I was away. Writing the higher-level parts proved a revelation. Python's powerful dynamic sequence types – the tuple, the list and the dictionary – enabled me to do away with fixed-length arrays and memory allocation altogether, and let me completely redesign the system.

The raw materials of my music remain strings representing sequences of pitch, time, duration and volume values. But now my top-level primitive called MIDIsq. phrase sucks in four such strings, like a ribosome chewing RNA, and chops them up into 4-tuples, which are far more flexible for further processing. Thanks to a different set of data structures, my long-range structure problems went away: both the horizontal (melody) and vertical (harmony) structures are now essentially limitless. I can write functions to generate random strings and reverse, invert, mix and even evolve them.

Python's lambda functions let me generate musical scales and apply them on the fly, while iterators offer a compact way to encode stretches of melody.

I'm impressed by this textbook example of what the more savvy computer scientists have been telling us for decades, namely that programs equal algorithms

plus data structures, not just algorithms. This deep truth is in danger of being lost, partly thanks to the awful languages the market has foisted upon us, and partly due to the TED generation's naive awe of algorithms.

In popular journalism, algorithms are all we ever hear about: Google's new search algorithm and the latest AI algorithms. Yet neuroscience teaches us that the brain is hardly an algorithmic engine at all, and depends little on sequential processing. It's more like a big, soft, fatty mass of fabulously clever data structures. But enough of that: back to my *Contracerto in Z Flat Minor*.

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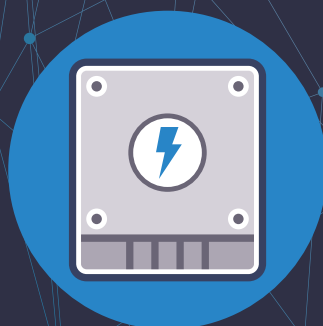


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Readers' comments

Your views and feedback from email and the web

Credit where it's due

Hardware problems, like London buses, come along in twos and threes. Having experienced the misfortune of an ageing desktop all-in-one going on the blink at the same time as a brand-new laptop, I can sympathise with those people who report the disconcerting feeling of immediate PC bereavement. However, once the initial giddiness subsided, I was left to cope with the practicalities of dealing with different suppliers to try to get matters resolved. I didn't hold out much hope for the desktop machine, as it was one month out of warranty.

However, I was promised a replacement as soon as I called Dell. The company couldn't have been more helpful, with emails and calls from customer services personnel at various levels checking that I was satisfied with all that had been done – I was.

Unfortunately, the contrast with a well-known online and high-street vendor couldn't have been more marked. The laptop was just a few weeks old, but the retailer insisted on taking it back for repair rather than issuing a replacement. Factor in the wait for replacement parts from the manufacturer, plus the omission of the mains lead when the item was returned, and I still haven't enjoyed a functioning laptop more than a month later.

Then there's the hours (no exaggeration) spent on the phone, listening to pleasant but infuriating on-hold music interspersed with "I'm sorry, our agents know you are waiting and will be with you as soon as possible", only to be told by customer support that it's "nothing to do with us, guv, you need to speak to technical" and then for technical to just shunt me back to customer support.

I'm sure other readers will have been here many times, but the lesson is clear: customer service is

Star letter

Cortana seems to be the price we're expected to pay for Windows 10. I have nothing to hide, but I didn't ask for it and don't like Google, Microsoft or any other company tracking my use of the web.

Like many, I downloaded "Shut Up 10" to take back some control of my PC, but I still found my hard drive light flickering and Cortana using both memory and processing power, even with search disabled. It isn't doing that for nothing, is it?

The answer given to a user of the Microsoft Community forums when he asked why processes run, even when they have been disabled, was: "It's

your computer but it's Microsoft's operating system". Perhaps that says it all. I'm using its operating system and I haven't paid for it.

For me, the MSFN Forum (msfn.org/board) provided a solution, proving it's possible to remove Cortana. But will the Windows community always be able to keep a step ahead of Microsoft? Probably not, which means that I need to begin looking at other solutions. Magazines such as yours need to be catering for people who, like me, aren't a commodity to be bought and sold by Google and Microsoft. **Peter Williams**



This month's star letter wins a set of Creative T50 wireless speakers, worth £100. To find out how they could give your music a boost, visit uk.creative.com

king and sellers ignore that at their peril. I ought to say that I don't work for Dell and have only ever bought one item from the company, but I know where I will be going for IT purchases in the future. **Neil Roskilly**

Windows 10's disappearing Start button (continued)

Reading Tony Blench's letter (about the disappearing Start menu button in issue 257) struck a chord with me. I get this error on my four-year-old Dell XPS 17 frequently, curiously on a Wednesday or Thursday. My wife has just bought a brand-new Windows 10-certified laptop and it happens to her too.

The cause appears to be Windows Update after "Patch Tuesday", or rather its failure to complete. My personal fix, which doesn't include reinstalling Windows, is to manually run Windows Update and reboot. This works until the next Patch Tuesday. **Simon Fitton Davies**

I have had this half a dozen times and it seems to occur if I leave the PC for a period of time in a screen-locked state. I have tried various solutions, including following the suggested fix on Microsoft's website, which was

complex and didn't work for me. The only one that temporarily resolves it is to hit Ctrl+Alt+Del and select Switch User. Then click on the power button in the bottom right of the screen and choose Restart.

Powering off doesn't solve it, though. After logging in again, all is well until the next time.

Peter Townsend

A solution that worked for us, after much trial and error, is at **pcpro**. [link/258startmenu](https://www.pcpro.co.uk/news/258startmenu), particularly opening a PowerShell window and copying in the command line given at step four.

Sadly, a quick search of the web shows that thousands of people have been suffering from the same problem – for many months. Microsoft appears to have ignored this, being unwilling or unable to provide a comprehensive solution in their standard updates.

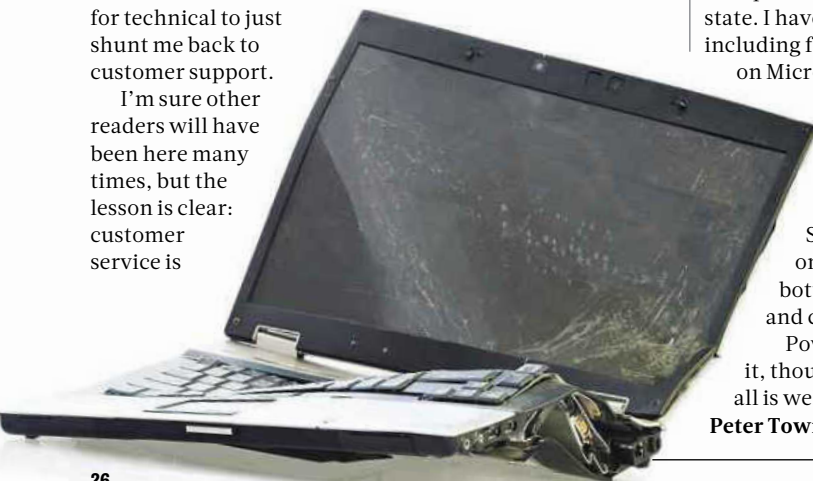
“By not providing a fix in six months, Microsoft gives the impression it doesn't care about the user experience”

Losing the Start menu, the prime way to get at programs in Windows 10, is infuriating and wastes users' time. Not providing a comprehensive fix in six months gives the impression that Microsoft doesn't really care about the user experience anymore.

What company would accept its staff being hampered by such a lack of reliability and support? We have only experienced Windows 10 on one computer so far and don't want to waste any more time on it until these problems are resolved. We can't rely on Windows 10 as it is. **Mark Swabey**

Editor-in-chief Tim Danton replies: First of all, thanks to everyone for taking the time to reply with your solutions. Sadly, we didn't have space for them all. In pursuit of a more permanent answer, we also emailed Microsoft's PR company. It replied: "We cannot provide a comment

BELOW Customer service is king and retailers ignore fixing hardware issues at their peril



from Microsoft on these user issues. However, Microsoft would be more than happy to help the users with their individual issues via its support service at this link: support.microsoft.com/en-gb/contactus." Not the most helpful reply we've received, so it looks like this problem may rumble on and on...

Windows 10 money saving

I have for some time been waiting for the January sales to buy a new desktop PC. Luckily (or unluckily), a few months ago my laptop was upgraded to Windows 10.

This has been nothing but a pain. An initial easy change from Windows 7 has been followed by hour-long updates, stalled updates... and now that pain is over I find that the laptop fan is running full speed while the processor runs at 98% at worst, with 50% dedicated to running processes I never saw in task manager with Windows 7.

Forget broadcasting iPlayer to my PC: the laptop is far too busy to give a smooth picture and coherent sound. This is a problem I never experienced on this machine when running Windows 7, yet my tablet handles iPlayer with ease.

So, to the saving money. I found a desktop with the latest processor and a good graphics card with £100 discount and then realised that this would mean Windows 10. No way can I accept this so it looks like a further period with reliable, unflustered Vista on my old desktop until the advent of a SP1 version of Windows 10. A good money saving!
David Haynes



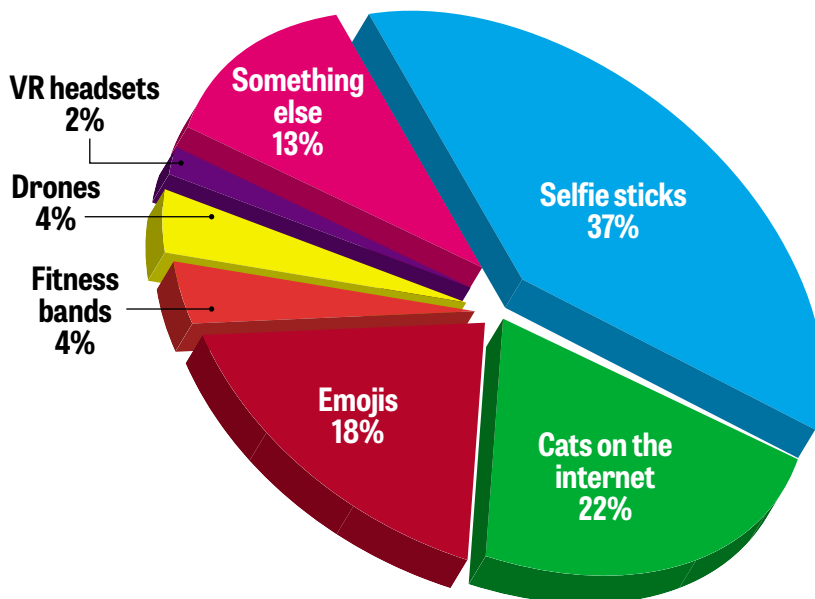
PC Pro links

I am unable to find out how to use the links (pcpro.link/xxxx) mentioned in various articles and reviews in the magazine. I am a long-standing subscriber so I am sure that I must have missed something somewhere, so could you please point me in the right direction. **John Brockman**

Editor-in-chief Tim Danton replies: Many thanks for your email and sorry for any confusion! These are like bit.ly links – in fact, we use bit.ly to provide the service – and if you enter them in your browser, they redirect you to online content either mentioned in articles, or that supplement content within the magazine. Do let me know via editor@pcpro.co.uk if any don't work, as mistakes do happen. If we can correct the links, we will.

Readers' poll

We asked you: which of the current tech crazes is just a fad?



There was a clear winner, with selfie sticks streaking ahead. Rather disappointingly, cats on the internet came second (we clearly have lots of dog lovers among us).

One anonymous rationalisation for the death of selfie sticks was very logical: the potential to invade other people's privacy. The voter explained: "Selfie sticks are pointless and obstruct the view for others. Also the picture could have people [in it] that don't want to be included in the picture."

Another respondent (who also chose to remain anonymous) called cats a "waste of bandwidth and server capacity".

Join the debate



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“Selfie sticks create a world of self-obsessed people” **Tony**

“Facebook. I see no advantage to the planet that Facebook brings... only the dumbing down of society to the point that we believe nothing unless it's in our News Feed” **Daniel Eastwood**

“Selfie sticks. It's really annoying to have to navigate through people who stop or are standing in the way to strike and frame the perfect pose” **Anonymous**

“What fad do I hope will disappear? Polls” **Anonymous**

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CES STARS

The best from CES 2016

Meet the exciting products on show at CES 2016, including our 10 “Top Picks of CES” for the most outstanding new pieces of tech

Jonathan Bray, Tim Danton and Jon Honeyball

When Las Vegas hosts a technology show, it doesn't scrimp. There is no bigger tech event than the Consumer Electronic Show (CES), with its product releases, keynote speeches and monstrous stands. Here, we highlight the key products so that you get all the flavour of CES without having to tramp the halls.

Every year we see several new trends being pushed at CES, but we're old and wise enough to keep a weary eye out for hype over substance. We still have the scars from two consecutive CES shows when Sony, Samsung and the rest were pushing 3D TVs as if they were the saviour of home entertainment. This year? Nary a mention.

Instead, the talk was of self-driving cars, connected homes, fitness, sleep and health trackers, and OLED screens. But it wasn't just talk: we got our hands on exciting new products too, and over the next few pages we include extended, first-look reviews of the ones we thought were most interesting.

However, before you get too excited, take a close look at the release dates. Hard-earned CES experience tells us there's every chance they will be delayed. Some may never be released at all, or be limited to certain countries.

Then again, if even half of what we've seen is released, it looks like another bumper year of tech. Enjoy!

Acer Chromebook 11

PRICE \$179

ON SALE February 2016

WEBSITE acer.co.uk

Looking for a cheap, solidly built Chromebook with style? The new Acer Chromebook 11 looks just the ticket, selling for \$179 in the US for its low-end model (2GB of RAM, 16GB storage and Celeron processor). Weighing 1.1kg with an aluminium cover, and with a promised nine hours' battery life, its only weakness is a low-resolution 720p display.



atmospheric pressure, switch to compass mode and head over to the tide graph. This really is a watch for explorers.

Casio targets those who trek, cycle and fish. When you're cycling, one screen shows your speed, the time, how far you've travelled and how long you've been cycling for.

Trekkers and climbers will see similar information, but this time it's their goal elevation, how many more feet they must climb, their speed in feet per hour. Those who fish can see a graph of how the atmospheric pressure is changing over time.

There are 40 different actions that will trigger notifications – "Casio Moments" – along with all the usual reminders and pings you receive from Android Wear. Currently, there are three companion apps to take full advantage of, if you own an Android phone: ViewRanger (a specialist outdoor mapping tool), MyRadar ("the world's most popular weather radar map") and Runkeeper. iPhone owners will have to wait until launch to find out how compatible the Casio Watch will be – all Casio could tell us was "it will be compatible with iOS, but not fully".

It certainly isn't cheap, but if you're a committed outdoors enthusiast then at least you can be confident of a watch that will survive a trip to Snowdonia and back.

★ IN DEPTH

PC PRO
★ 2016 CES ★
TOP PICK

Casio Smart Outdoor Watch WSD-F10

PRICE \$500

ON SALE April 2016

WEBSITE wsd.casio.com

Unlike most Android Wear watches, the Casio Smart Outdoor Watch WSD-F10 will survive even the fiercest conditions. It's compliant with the MIL-STD-810G military standard, while Casio promises water resistance to 50m. It's even designed to be used with gloves, thanks to chunky buttons that match its hefty design. At 15.7mm thick, you'll notice this on your wrist.

Cleverly, there's an always-on mono display that will be perfectly visible in sunny conditions. Switch everything else off and the Casio could last a whole month between charges. In reality, though, you won't be able to resist switching on the crisp, colourful 320 x 300 touch display.

The wow factor comes not from the screen, but the content it shows.

Sure, it will tell you how many steps you've taken, but what other watch will update your altitude as you swipe through the screens? You can also check



Dell Latitude 11 5000 Series 2-in-1

PRICE From \$749

ON SALE February 2016

WEBSITE dell.co.uk

Like its big brother, the Latitude 12 7000 (see *overleaf*), the Latitude 11 5000 matches a classy two-in-one design with business-friendly features. Think easy manageability, encryption and "government-grade" security options. It takes many of its design cues from the beautiful Dell XPS 13, with a magnesium finish and punchy 10.8in, 1,280 x 1,080 screen. The tablet measures 10.8mm thick and weighs 710g – very respectable considering it has a Core m3 or Core m5 inside, and crams in a regular USB Type-A, USB Type-C and micro-HDMI ports, as well as a microSD slot.



PC PRO
★ 2016 CES ★
TOP PICK



★ **IN DEPTH**

PC PRO
★ **2016 CES** ★
TOP PICK

Dell Latitude 12 7000 Series 2-in-1

PRICE From \$1,049

ON SALE February 2016

WEBSITE dell.com

There are two ways manufacturers can go when building a two-in-one tablet hybrid, such as the Latitude 12 7000. They can build a kickstand into the chassis of the tablet, as with the Surface Pro 4, or they can make a folio case in the style of the iPad Pro.

The Latitude 12 7000 takes the second route, wrapping its 12.5in tablet in a case coated in what can either be described as a school-trouser finish or a smart-suit grey, depending how charitable you feel.

That said, it's a practical design. When the tablet is docked in the keyboard case – courtesy of a series of magnets and contacts in the centre of one edge – it can be used as a compact laptop. It can also be propped up at any angle, thanks to an adjustable kickstand. This makes it ideal for a desk, but less suitable for lap-typing, since there's a gap between the kickstand and the rear of the keyboard.

The base of the keyboard feels stiff and its backlit keys are comfortable to type on, with a decent amount of travel and a soft, cushioned action that's more akin to what you might expect of a high-quality Ultrabook. But it's the touchpad that most impresses: its silky finish has a high-quality thunk when you click the buttons.

It's also light: the tablet part weighs 731g and measures 8.1mm – not bad for a 12.5in tablet – while the keyboard adds 673g and 17mm for a total weight of 1.4kg and thickness of 17mm. It's worth noting that Dell will also be offering a battery-booster keyboard option that adds a mere millimetre to the overall thickness.

If you fancy slinging it in a bag for a spot of work in a cafe, it will weigh you down no more than a Surface. Once you get back to the office, there's no shortage of connectivity, with two USB Type-C sockets, optional 4G and a microSD expansion slot.

Dell offers the option of a Gorilla Glass-topped 3,840 x 2,560 IPS touchscreen, which delivers a pixel density of 352ppi and claimed top brightness of 360cd/m². This is a sharper screen than the Surface's. Dell also offers pressure-sensitive

stylus compatibility, but its "Active Pen" is an optional extra.

And you can't pick a high-end processor. The 7000 is only available with the latest Intel Core M processors (2.2GHz m3-6Y30, 2.8GHz m5-6Y57 and 3.1GHz m7-6Y75.). That's good for battery life, but not for CPU-intensive tasks such as video encoding.

Dell UltraSharp 30 OLED Monitor

PRICE \$4,999

ON SALE March 2016

WEBSITE dell.com

PC PRO
★ **2016 CES** ★
TOP PICK

At first glance, this 30in OLED screen puts to shame the IPS panels we've become so used to. However, it's not just for boasting rights. Showing 100% of Adobe's RGB colour gamut, the Dell UltraSharp 30 OLED has obvious appeal for creative professionals. The difficulty will be switching back to a normal display in everyday life.

Emfit QS

PRICE £259

ON SALE Now

WEBSITE qs.emfit.com

There was no shortage of sleep trackers at CES 2016, but if you want a truly accurate reading, then Emfit QS stands out. Its sensor slides under your mattress, but still tracks movement and heartbeat levels, giving a great indication of both the quality of your sleep and your stress levels. It's potentially of greatest use for tracking patients' recovery and athletes' training, but you can buy it for personal use too.

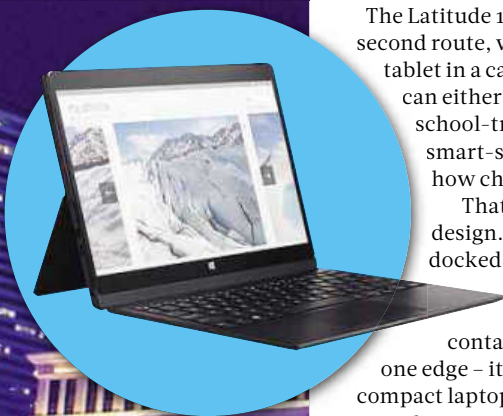
Fitbit Blaze

PRICE £160

ON SALE March 2016

WEBSITE fitbit.com/uk

We're still waiting for the perfect fitness smartwatch, but the Fitbit Blaze edges us closer to that goal. There's a lot to like: a heart-rate monitor; five-day battery life; onscreen workouts; multiple sports settings; silent alarms and versatile straps. And, of course, a tie-in with Fitbit's excellent apps and network. The price looks right, too.





The weirdest tech at CES

We spoke to a number of startups at CES who were looking for funding, publicity or distribution. We're not saying they won't succeed, but they are a bit bizarre...

PetBot

IT IS... A webcam for your pet

PRICE \$189

WEBSITE petbot.co

"Petcam for People. Smartphone for Pets." That's the tag line for PetBot, which is currently on Indiegogo, and is due for delivery in May 2016. The idea is pretty simple: it's a webcam fitted in a plastic housing that can dispense treats to pets at your command. Naturally, you can talk to them too, and it can automatically take "pet selfies" when they come close. We think it sounds barking, but if you disagree you can order a unit for \$189 with a promised delivery date of May 2016.



More weird tech on p36 



Fitkat Edge

PRICE \$100
ON SALE TBC
WEBSITE fitkat.me



It felt like there were countless small companies offering fitness watches at CES, but what attracted us to Fitkat was its focus on affordable, focused products. It launched a simple Fitbit-style band, called Ultimo last year, and had two new products on show at CES 2016: Pulse, a square-faced smartwatch with a heart-rate monitor, activity tracking and skin-temperature measurement for \$120; and Edge, a faintly stylish step, calorie and sleep tracker for \$100.

ports to the MacBook's one. You'll still have to buy new cables, or HP's Travel Dock, but you won't need an adapter just to charge it at the same time as hooking up a monitor or hard disk. At this end of the market, it's the small things that matter.

When it comes to the smallest things of all – pixels – the HP gains another jump over the MacBook. Crammed into its 12.5in display is an incredibly sharp 4K, 3,860 x 2,160 resolution IPS LCD panel with a pixel density of 352ppi. The MacBook's, for reference, is "only" 226ppi, although most people will struggle to see the difference between the two from normal working distances.

Being a Windows 10 machine, the 4K display on the HP EliteBook Folio is also a touchscreen. HP also claims Adobe RGB coverage of 95%. Side by side with a MacBook Pro 13in, it made an excellent first impression: bright, with excellent viewing angles and strong contrast.

From an ergonomic standpoint, the Folio acquitted itself equally well. The "premium" keyboard is a refinement of the one built into the EliteBook 1020, and it feels fabulous. HP has also, thankfully, stepped back from the odd "emulated-click" touchpad on the Folio's predecessor in favour of an old-fashioned mechanical click pointing device.

At a starting price of €999 (UK prices have yet to be finalised), it looks as though the Folio will be a bargain, too. Before you whip out your wallet, though, this price is for the base model with the standard, non-touch 1,920 x 1,080 display. The touchscreen model with the 512MB of PCI Express flash storage and 4K resolution is likely to be pricier.

★ **IN DEPTH**

HP EliteBook Folio

PRICE \$999
ON SALE March 2016
WEBSITE hp.com/go/elitebookfolio

Design-wise, HP's EliteBook Folio is the match of the 13in Apple MacBook. It's the lightest laptop HP has ever made, at a bird-like 1kg – a mere 77g heavier than the MacBook, despite a 0.5in larger screen. Its hollowed-out, CNC-machined aluminium chassis is 0.7mm slimmer than Apple's laptop.

The EliteBook Folio's chiselled figure, chamfered edges, chrome-effect piano-hinge and sparkly matte finish may shout "buy me" rather than whisper it seductively, but there's no denying its visual appeal. We particularly like the fetching speaker grilles, hiding four Bang & Olufsen-branded drivers, but practical features abound, from the fold-flat screen hinge to the military-standard testing the laptop has been put through.

The MacBook's Achilles heel was its lack of connectivity and power. In a disappointing move, HP hasn't sated our desire for a more powerful processor: it will only be available with low-power Intel Core m5 and m7 CPUs. On the plus side, these will be of the most recent Skylake variant, and – just like the MacBook – the Folio will be fanless. HP is claiming ten-hour battery life, similar to Apple's claims.

However, it outdoes the MacBook in connectivity, with two USB Type-C

PC PRO
★ **2016 CES** ★
TOP PICK



★ **IN DEPTH**

HTC Vive Pre

PRICE TBC
ON SALE May 2016
WEBSITE htcvive.com

PC PRO
★ **2016 CES** ★
TOP PICK

The best virtual-reality system just got better. The previous generation of HTC's technology already offered 1,200 x 1,080 pixels per eye delivered at 90fps, but a host of improvements make it more immersive than ever.

The twin wireless controllers work the same way, but they're smaller and more neatly designed than the version we saw last year, and they now have rechargeable batteries, making them a more consumer-friendly proposition. The headset is now lighter, too.

The big new feature, though, is

Hummingbird [Colibri Thalassinus]

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the pass-through camera, which is mounted at the bottom edge of the unit, facing forwards. This circumvents one of the big drawbacks that

VR headsets are afflicted by: you can't see the world around you. HTC and Valve have already tried to address this with the first Vive's "Chaperone" system, which used a blue grid to delineate the playing space (up to 15 x 15ft in size).

The pass-through camera adds another dimension to the system, identifying not only room boundaries but also objects within it. You won't need to fumble around to find your controllers, keyboard and mouse.

If you fancy a cup of tea while you're piloting a virtual spaceship, you can do that too: a quick double-tap of the home button on one of the redesigned controllers brings up a *Terminator*-style view of the world.

A key factor is the software. We're a long way from VR software being a mature, competitive market with lots of high-end programs jostling for your attention, but the four virtual worlds we briefly inhabited all gave a glimpse into a virtual future.

In one game, we were transported to a future where humans no longer work. So what do they do for fun? Why, they pretend they go to an office of course, and "play" at being an office drone. It wasn't the 3D graphics that made the experience interesting but the interaction with objects: picking up a virtual coffee mug as our hand made a similar movement with one of the controllers.

As always with VR, the real treats lie in the future: we'll have to wait until May for consumer versions of the headset, but 7,000 developers will be receiving the latest "Pre" version we tested at CES.

The best way to explain the difference between 14 inches of OLED beauty and even a top-notch IPS display is to imagine two paintings side by side: one a watercolour, the other in pastels. The end result is that, afterwards, other screens look drab.

There is a battery hit. Lenovo says the new ThinkPad X1 Yoga lasts 11 hours with the IPS display, but only nine hours with the OLED screen. You may also find that photos that look fine on a typical display suddenly look oversaturated on OLED.

The other big change, as the name "Yoga" suggests, is that the keyboard flips around 360 degrees. Now you can use it in laptop mode, tent mode (like an inverted "V"), stand mode and as a huge tablet. The keys retract into the base for the latter, to make the rear feel flatter in the hand.

When using a 14in "tablet" that weighs 1.27kg, however, we suspect most people will rest it on a table or their legs, perhaps scrawling notes during a meeting using the ever-so-clever "Stylus Pen". This stows away inside the base of the Yoga, which is also how you charge it. If the stylus' battery starts to run low (after around two hours) then inserting it back into the slot for a mere five seconds will inject 100 minutes' worth of charge.

There are a few less dramatic improvements to the X1 Yoga over the X1 Carbon of 2015. One is a smaller power supply that can quick-charge the X1 to 80% within an hour. There's also a wide range of ports, including three USB 3, a microSD slot and Lenovo's updated Onelink+ connector. You can connect Lenovo's new compact docking station to this, which includes an Ethernet port and support for output to dual 4K displays.

All of these small improvements apply to the updated Lenovo Carbon X1, and both machines share the same internal components, including the latest Intel Skylake processors, right the way up to a Core i7 vPro. Even storage is given a boost via a fast NVMe SSD. This laptop can be as stunningly powerful as you want it to be.



★ IN DEPTH

★ **2016 CES** ★
TOP PICK

Lenovo ThinkPad X1 Yoga

PRICE From \$1,449 with IPS screen

ON SALE February 2016

WEBSITE lenovo.com/uk

Question: what do you do after creating the last word in business ultraportables? One that's "dripping with features", to quote our review of the Lenovo ThinkPad X1 Carbon. A laptop that packs power and a 14in screen into a chassis weighing a shade over 1kg. The answer is to kit it out with an eye-popping OLED screen.

The Leatherback Turtle swims over 11,000 miles while migrating, travelling across the Pacific

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Equisense

IT IS... A Fitbit for horses

PRICE €299

WEBSITE equisense.com

It's easy to be flippant about this sensor for horses, but we have a sneaking suspicion it will appeal to lovers of all things equine.

It attaches to the saddle and lets you monitor gait, symmetry and the "quality of locomotion" with an app (on both phone and Apple Watch) that gives you live data so you can adapt the session as necessary. For example, you can analyse the path, cadence, elevation and stride length of a dressage session. There's even the promise of spotting early signs of lameness, with the team behind Equisense apparently working with vets to ensure the data is meaningful. The first shipment is due for delivery in spring and you can register your interest at the website.



GPS Locator for Old Man

IT IS... Um, a GPS locator for old men

PRICE TBC

WEBSITE adition.com.cn

We admit we mainly love this product for its name, but once we stopped our childish sniggering we could see its merits, too. Roughly the size of a travel alarm clock, the GPS Locator for Old Man – made by Chinese company Adition – clips to a belt or key ring and lets you track the movements of elderly relatives (Adition produces a similar product for pets). You can also geofence an area and be alerted if they wander outside its bounds. There isn't yet a release date or price, but if you're interested check out the much less interestingly named iTraq, which is available for pre-order for \$129 at itraqtag.com.



More weird tech on p39

★ IN DEPTH

PC PRO
★ 2016 CES ★
TOP PICK

Lenovo ThinkPad X1 Tablet

PRICE From \$899
ON SALE February 2016
WEBSITE lenovo.com/uk

Yes, the X1 family now includes tablets. It's an interesting move, especially as Lenovo takes the tablet idea further than its rivals courtesy of plugin modules.

First, there's a "productivity module". It boosts the X1 Tablet's ten-hour battery life by an extra five, but also adds a USB port, Onelink+ connector and an HDMI video out.

The optional keyboard turns it into a proper little PC.

You can also buy a "3D-imaging module", with which to capture and edit objects in 3D. A "presenter module" that includes a Pico projector capable of displaying a 60in picture from 2m is due for release in May.

All interesting ideas, but the mechanical locks for connecting the accessories feel a little clunky.

The device weighs 795g without the keyboard or modules, which is what we'd expect from a tablet with a 12in screen. Speaking of which, this one looks like a competent IPS display – it has a 3:2 aspect ratio and a resolution of 2,160 x 1,440 – but frankly everything looks drab after the OLED panel on the X1 Yoga.

Adding the keyboard increases the weight to 1.1kg, which is pretty good for a 12in laptop. We weren't able to test the keyboard itself (the units were trapped in customs), but a keystroke depth of 1.35mm suggests it should be a pleasure to use rather than a chore. There's even a trackpoint for ThinkPad traditionalists.

Don't expect cutting-edge power, because Lenovo employs a Core M processor rather than a fully fledged Core i5 or Core i7. In testing, we've found these throttle back once you start pushing them, but they're fine for occasional bursts of activity, and Lenovo has eliminated another performance bottleneck by using superfast NVMe SSDs.

We're not certain the X1 Tablet will take off, but Lenovo deserves credit for not only thinking about how tablets can be enhanced but for putting such an innovative product on the shelves. It's great to see innovation such as this given a chance to succeed rather than stifled at the ideas stage.



Luna 360 camera

PRICE \$299
ON SALE October 2016
WEBSITE luna.camera

Imagine a black pool ball with two 190-degree fish-eye cameras embedded into its surface, and you won't be too far from visualising the Luna 360 camera. It promises to "make shooting in 360 degrees as easy as taking photos with your phone", with a single button on its top. You can send the results to your phone via Luna's mobile app, view the results in "immersive virtual reality" via Google Cardboard and live stream to friends and family. Clever.



Naim Mu-so Qb

PRICE £595
ON SALE Spring 2016
WEBSITE naimaudio.com

PC PRO
★ 2016 CES ★
TOP PICK

The Naim Mu-so Qb wireless speaker caught Jon Honeyball's eye – or, more accurately, ear – at CES thanks to its "exceptional engineering and sound quality in a small package". An 8in square box, to be precise. Naim has squeezed in five drivers to create what the company calls "a lift-right dispersion asymmetry", while two passive bass "radiators" work to ensure it hits low frequencies. It's wrapped up in a stylish finish and supports multi-room audio.

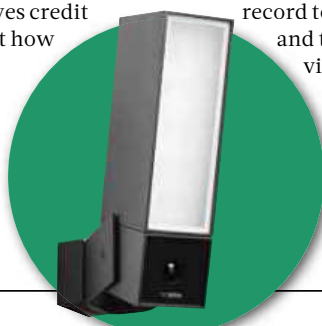


Netatmo Presence

PRICE TBC
ON SALE Late 2016
WEBSITE pcpro.link/258presence

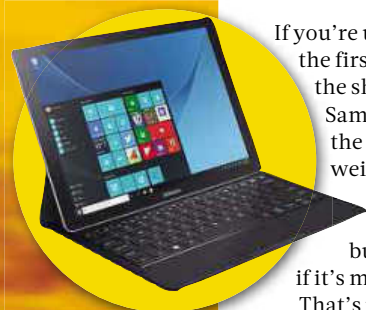
PC PRO
★ 2016 CES ★
TOP PICK

Most motion-activated security cameras will catch anything: man, dog or balloon. Netatmo's Presence camera is cleverer, identifying cars, people and animals at night and day. At night, you use the infrared sensors or switch on the floodlight, which acts as a deterrent if you switch it on when it detects movement. You can also record to a microSD card and transfer recorded video to your FTP server, avoiding subscription costs. It's a smart-home security system that, Netatmo told us, will cost "less than \$300".



★ **IN DEPTH****PC
PRO**
★ **2016 CES** ★
TOP PICK

Samsung Galaxy TabPro S

PRICE TBC**ON SALE** February 2016**WEBSITE** samsung.co.uk

If you're used to a Surface Pro, the first thing you'll notice is the sheer lightness of the Samsung TabPro S. Without the keyboard, this 12in tablet weighs 693g. And with the keyboard – well, nobody seems to know for sure, but we'd be very surprised if it's more than 1kg.

That's partially because there isn't much to the keyboard other than plastic, with no hidden battery to add to Samsung's claimed 10.5 hours. This means it adds only 4.9mm to the 6.3mm of the device itself, but the slenderness has a knock-on effect when it comes to key travel. The touchpad is compressed too, even for a compact laptop, which meant we had to concentrate to avoid pressing the left- and right-click buttons.

Another drawback of Samsung's design, compared to the adaptable hinge of the Surface, is that there are only two screen positions: an upright, let's-do-some-work angle, or a let's-chill-and-watch-a-movie angle.

But, whatever you choose, the screen won't disappoint. Using Super AMOLED technology, its 2,160 x 1,440 resolution means there's plenty of vibrant colour and crisp detail. Video output is via a single USB Type-C port, with Samsung offering a cute mini-adaptor that will add two USB ports and one HDMI output (it also promises an optional Bluetooth pen).

You probably don't want to use this as your main laptop, though, with a Core M processor in charge. It should be plenty for everyday duties, but we know from experience with Core M laptops that they don't perform well in CPU-intensive tasks.

You'll also quickly hit the limits of the 128GB SSD (a 256GB version might become available in the UK), but we don't mean to be too harsh: the Galaxy TabPro S would be absolutely fine as a second PC and, as it uses Windows 10, it will be a flexible little machine.

That's if it ever reaches these shores: a year ago, Samsung pulled out of the European market for laptops, and this does feel more of a laptop than a tablet. There's one more piece of information that remains elusive: Samsung is being coy on the price, despite the fact that the

TabPro S is due to launch imminently. If it gets that final piece of the puzzle right – and we know the keyboard will be included – this could pose a serious threat to the Surface.

SanDisk Extreme 510 SSD

PRICE £199**ON SALE** Now**WEBSITE** sandisk.co.uk

Photographers looking for a robust SSD should take note of this "extreme" SSD from SanDisk. It's waterproof (IP55), packs in 480GB of storage and has a sturdy design that can cope with the most challenging of environments – from -20°C to 70°C. It's fast, too, with a promised write rate of 400MB/sec over USB 3.

Smart Wheel

PRICE \$200**ON SALE** Mid-2016**WEBSITE** smartwheelusa.com

While automated driving was one of CES's hottest topics, Smart Wheel had a different and more immediate solution: a steering wheel cover that "helps prevent distracted driving". It snaps on to any steering wheel, with no plugs or wires, while feedback encourages drivers to avoid distractions: a red light and beep tell you to move your hands back into a safe position. There's also an app that tracks trip data and grades your driving. Not a bad solution as we wait for Google, Apple and Nvidia to remove the steering wheel altogether.



Stabilo Digipen

PRICE €150**ON SALE** July 2016 or later**WEBSITE** stabilo.com/uk

Who needs tablets when you can capture your handwriting on ordinary paper? So wonders Stabilo, who claim the biggest benefactors of this device will be the education and medical sectors. You simply write and the notes appear on your phone, tablet or PC. This spring it will be shipping units to German schools to see how students get on with it, but it plans to launch a crowdfunding campaign this year.





BrainCo

IT IS... A brain-controlled communicator
PRICE TBC
WEBSITE brainco.tech

It's a tantalising idea: use your brain to switch on a light, to control a robotic arm, even send a message to someone. After all, we know that concentrating on certain things sends electronic pulses; all you need is a way to record them and then send that on. It isn't a new idea, but at CES BrainCo was demoing a prototype that sits like a tiara on your head. Sadly, it wasn't working in the Wi-Fi-infested



halls when we walked past, but with promises of improving your attention span, smart-home control and "early nerve disease prevention" it could be one to watch.

Click'n'Pizza

IT IS... A pizza-ordering fridge magnet
PRICE TBC
WEBSITE lacomanda.it

What's not to like? Simply attach the Click'n'Pizza to

your fridge and you'll need never manually order a pizza again. The circular, mono LCD is surrounded by a dial: turn it to select your favourite toppings, take advantage of any promotional offers and then click to buy. It's "the future of e-commerce" according to Italian Internet of Things

company, La Comanda. With no hint of irony, it will begin a partnership with a Pizza Hut in the Ontario area of Canada this spring. La Comanda is now working on a European launch, it tells us.



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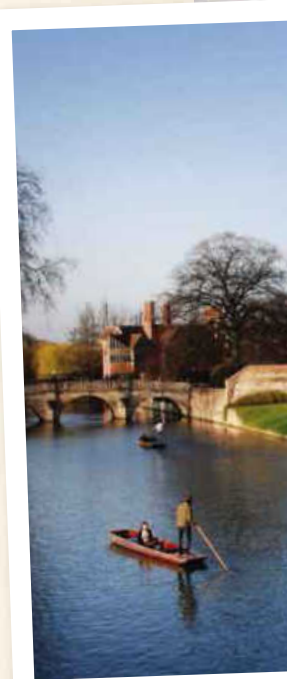


BIRTH TECH

FIVE GREAT PLACES TO BASE YOUR TECH STARTUP



Starting up your own tech business? **Nicole Kobie** explores the alternatives to moving to East London



London is the epicentre of the British tech startup scene. According to a report from Tech City UK, roughly a sixth of the 1.46 million people employed in digital companies across the country are based in the capital – the tech population of Bristol, Bath, Manchester, Reading and Leeds combined still doesn't add up to London's share.

However, another report suggests that the balance may be starting to shift, with as many as two-thirds of London startups saying they considered leaving the capital after their first year in business.

London might be the current tech hub, but what if you can't afford to pay the skyrocketing rents? Is it worth paying a premium or should you consider growing your startup somewhere else?

LONDON CALLING

There are plenty of compelling reasons why East London is a magnet for startup entrepreneurs, and it's nothing to do with the availability of a good flat white. The capital has 47 universities; access to the City's financial investors; a host of co-working spaces to ease the cost of rent; and the networking opportunities that come with being right in the thick of it.

John Harthorne, the CEO and founder of startup accelerator MassChallenge, set up in Britain for the first time after five years in Boston and headed straight for London.

However, the high rents posed a problem, and continue to do so, even for relatively established startups such as MassChallenge: in 2013, Colliers International said rents were up by 46% in the Tech City area – and they've been on the rise ever since.

As a result, MassChallenge couldn't find a home in the fashionable Old Street area, instead moving to Tobacco Dock near Wapping. In Boston, the local government simply gave the project free space in the city's new Innovation District. "We're always looking for free space, which in Boston was possible," he said. "In London, people would laugh and wipe tears away and be like, 'I can't believe you just said that aloud. It's not going to happen'."

London's high rents are why startup accelerators such as MassChallenge play such a key role. "A lot of our teams, because London is so expensive, have never actually been able to work together," Harthorne said. "And now for the first time... they have made incredible improvements, because they have been together."

That means startups can stay in London

"HIGH RENTS IN LONDON POSED A PROBLEM AND CONTINUE TO DO SO, EVEN FOR RELATIVELY ESTABLISHED STARTUPS"

and take advantage of other benefits, such as concentrated access to talent, money, networks, mentors and everything else that abounds in the capital. "You're going to go to the place where it's easier to get access to each of those resources," said Harthorne. "If you're just a little off and you miss it just barely, then you get zero. It's too risky not to be in a place with concentrated resources and access. It doesn't mean you can't succeed elsewhere. It's just harder."

MOVING FURTHER AFIELD

However, as anyone who lives outside the capital is tired of repeating, there is life beyond London. Proof of this is Tech City UK's own report, "Tech Nation", which shone a light on the tech startup clusters creating sparks outside the capital.

The green shoots spread all across the UK. Cambridge is home to some of the UK's greatest tech success stories, notably ARM; Bristol and Bath have their own incubator and science park; Brighton has over three times the number of digital companies than the national average, even more than London. Norwich, Bournemouth, Glasgow, Manchester and Belfast also play their part in a burgeoning tech startup scene, and there are startups springing up all across the country that have defied East London's gravity.



POSTCARD

CAMBRIDGE

London might be the most popular locale for startups, but Cambridge is the place to beat for tech heritage: the university city has nurtured 14 billion-dollar companies, notably Autonomy and ARM. Plus, as with Oxford, the city has a steady stream of elite university students – a key factor in looking for skilled staff for startups.

It also depends what you want to create: London is top dog for financial tech, but Cambridge is the only cluster listed in the Tech City UK report that has electronics and components as a specialisation. No wonder, then, that it's where ARM and the Raspberry Pi were born.

You don't need to be based in Cambridge itself to benefit. Fredi Nonyelu is founder and CEO of Briteyellow, an indoor networking and location-mapping startup. He lives in Milton Keynes, meaning he's only 35 minutes on the train from the benefits of the capital, but is based at Cranfield University Technology Park in Bedfordshire.

"We have access to world class, local universities for talent, as well as the London universities, Cambridge and Oxford," he said. Factor in the lower cost of living, easier commute and solid infrastructure and it's easy to see the appeal.

PLACE
STAMP
HERE

READING

When choosing where to base his firm, James Rosewell, the CEO and founder of 51Degrees, wanted to achieve three things: access to software engineers and graduates (which he found via the University of Reading); lower costs on salaries and office rental; and a reasonable commute and work-life balance.

"[We wanted to] create jobs that were attractive to people wishing to work part-time, particularly parents returning to work after having children," he said. "Twenty-five per cent of our staff are parents working part-time and with a commute of less than 20 minutes – usually on foot or bicycle."

Rosewell is particularly critical of high rents in London, advising startups to think twice before moving to the capital. "Startups need to do everything in their power to keep costs down, and office rent plays a huge part in this," he said. "Avoiding London is one way of doing this – unless, of course, the core business is dependent on a geographic presence there. It may feel like the right



thing to do to be in the hub of London, but it's crucial that startups look beyond this."

Unless you're in property, you're not the one benefiting from the popularity of Tech City, he pointed out. "Businesses that have certainly benefited from the rise of

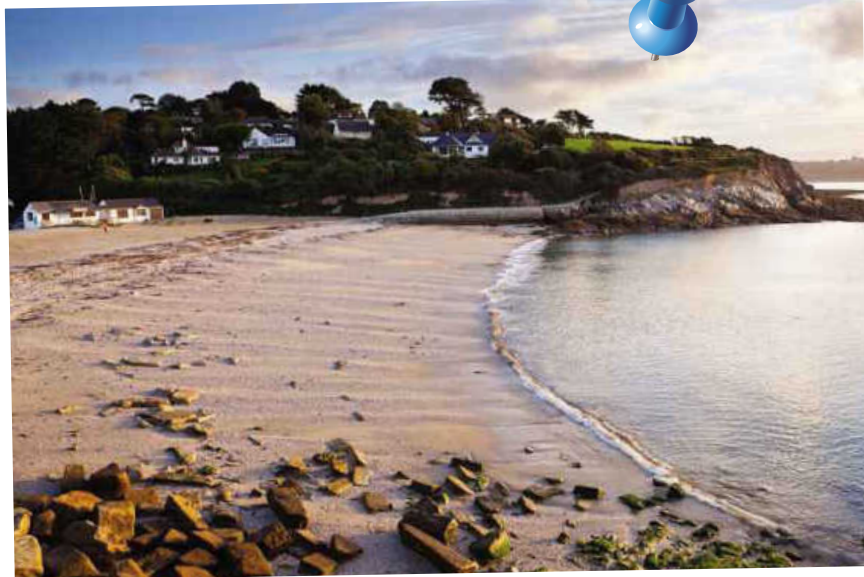
Silicon Roundabout and Tech City are those that own commercial property and housing," he added. "Rents and prices have increased far faster than they might have done otherwise. We are not in the business of fuelling property price inflation."

CORNWALL

Surf's up for startups: Cornwall's the place for anyone wanting to innovate in a more relaxed environment. The region doesn't make the Tech City report's ranking, but don't let that put you off, said TouchByte managing director Jeremy Sneller, who is based in Falmouth.

"Cornwall is a fantastic place to live, therefore work-life balance is absolutely fantastic," he said. "You can be working during the day and then go for a surf or a sail in the afternoon or evening."

And when you're in the office, you can rely upon a decent broadband connection.



POSTCARD

PLACE
STAMP
HERE

"Good communications is key, and the government has heavily invested in superfast broadband so we have fast access," he said.

While private investment hasn't trickled down from Old Street to Falmouth, the government has stepped in. "Because Cornwall is perceived to be an area where it needs investment, there are lots of government grants, so we make the most of those," he said. "Also, they've set up four innovation centres down in Cornwall, where they help startups and give them high-quality premises and access to people within the community."

Finding experienced staff is a problem, but TouchByte is happy to train locals. "In any business, getting good quality staff is probably the number one headache, and that's the same here," explained Sneller. "But because the options of slightly better salary roles are limited here, you tend to get talent doing mundane jobs. If we can offer them a career and a future and so on, we can pick up talent which we can develop."

"There's not this wealth of experienced people down here, so there tends to be a gap between the end of university and people having children. They tend to head up to London, but as soon as they want to settle down, they tend to bring them back to the area where they grew up."

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CARDIFF

Go west! You won't be lonely: South Wales, including Cardiff and Swansea, is home to 28,308 digital firms: an 87% increase from 2010 to 2013, according to the Tech City UK report.

You'll have your pick of co-working spaces and more reasonable property prices, and those surveyed said there's excellent access to public finance to help you start. While private finance is scarce and skilled workers are hard to come by, the five local universities mitigate recruitment problems.

"It regularly tops the polls of quality of life for UK cities," said Neil Cocker, of Cardiff Start, a tech startup network. "It's not difficult to see why – it's the fastest-growing capital city in Europe, but within literally minutes of mountains or sea, and with world-class sports, leisure, restaurants and nightlife. Low overheads mean your investment will go further, and the quality of life means staff are happier."

Key industries are health tech and life sciences, but Cocker also points to a growing financial-tech industry, helped by the presence of banks and insurers. "Insurance-comparison sites were essentially pioneered in Cardiff."

He's willing to admit the downsides. "Raising money can be tricky here, and we have less experienced tech entrepreneurs than other parts of the UK," he said. "But it's improving, and people are more than willing to help."



NEWCASTLE AND THE NORTH EAST

The Tech City UK report said companies in the North East are "some of the most positive in the UK about the benefits delivered by their cluster". Yet, for those unfamiliar with cities such as Newcastle and Sunderland, one of the major hurdles holding back the area is "perception of the region".

Tom Beardsmore founded games firm Coatsink in 2009, choosing to base it in Sunderland simply because that's where he's from. The area provides great access to graduates and experienced developers alike, thanks to specialised games courses at local universities and the larger studios based in the area – such as Epic Games, Ubisoft and Rockstar. "As a result, we've never wanted for skilled team members, which is by far the biggest benefit," he said. "It's also relatively cheap to operate up here, meaning we can invest more in our own products

and intellectual property, which is central to our growth and long-term strategies."

Helmut Okike works for mobile-payments firm Omlis, which set up in Newcastle because founder Markus Milsted thought London's tech scene was "saturated". Plus, by situating in Newcastle, the company was able to take advantage of local talent, rather than fight for staff in the capital. "We feel we're able to offer better

opportunities for local talent to gain more experience on the job with more responsibilities, accelerating their careers quicker than they'd be able to if they chose to go to London," added Okike.

"We've also had immense success in attracting talent from the South to the North to join our organisation," Okike added. "We actually have a member of the marketing team who moved from Santander in Spain to Newcastle upon Tyne just to work for Omlis. We're also able to attract a really high calibre of professionals who have family commitments and don't want to leave the region. This plays a large factor in their motivation to ensure that they do everything they can to ensure the success of our business."

Martyn Cuthbert's latest startup is Nutshell Apps, a zero-coding, drag-and-drop app-building platform. "Newcastle is ahead of the curve with established

technology hubs and a smart network of local investors," Cuthbert said. "There's a booming grassroots community of tech startup founders, developers and designers, supporting each other and building great things in the region."

There are big-name companies such as Sage Software, as well as investors such as Northstar Ventures and Rivers Capital Partners – plus, the region boasts plenty of government support. "The North East has seen huge transformations through sustainable economic development," added Cuthbert, with money flowing into the renewable-energy sector in particular.

Anyone can set up incubators and workspaces, but local enterprise agency PNE Group have won European awards for their startup facilities. "You can't ignore the considerable increase in the cost of living and rent, along with competition for talent and resources, in London," said Cuthbert.

"The UK economy is extremely London-centric," he added. "The beauty of technology means that it doesn't matter where you are based." That's worth remembering before you hop on the train to London. ●



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CYBER

WHY A GLOBAL SECURITY

A zero-day worm could disable
civilian infrastructure, including
nuclear power stations



CYBERGEDDON

DISASTER IS INEVITABLE

Attacks on TalkTalk and Wetherspoon's are a mere blip compared to what could happen to our global IT infrastructure. **Davey Winder** examines the genuine doomsday scenarios

Ambassador R James Woolsey Jr, a former director of central intelligence in the US, gave evidence before the Senate Homeland Security and Governmental Affairs Committee in July 2015. Woolsey warned that the US is "heading toward an EMP catastrophe", meaning a natural or man-made electromagnetic pulse represents an existential threat to the American people. "EMP is a clear and present danger," Woolsey said. "Something must be done to protect the electric grid and other life-sustaining critical infrastructures - immediately."

EMP weapons aren't the only electrical threat to civilisation as we know it. National-security experts use the acronym CHEW (cybercrime, hacktivism, espionage and war) to describe the risk to national economic, political and social stability. Given the number of high-profile reported data leaks, it's fair to assume that there are also plenty of unreported and undiscovered breaches. It's also fair to assume that the latter category is most likely to have been carried out by nation-state actors with the financial resources and technical wherewithal to successfully cover their tracks.

So far, the online world has proved pretty resilient when it comes to fending off attacks. However, the attack surface is always expanding, with increasing numbers and types of devices being added to the internet. Add to this the fact that both the nation-state and terrorist threats are better funded than ever before, and many security analysts will tell you that cybergeddon isn't only likely, but inevitable.

Over the next four pages, *PC Pro*, with the help of security experts, explores five potential cybergeddon scenarios.

"THE ATTACK SURFACE IS ALWAYS EXPANDING, WITH INCREASING NUMBERS AND TYPES OF DEVICES BEING ADDED TO THE INTERNET"

1 ZERO-DAY WORMS ATTACK CRITICAL NATIONAL INFRASTRUCTURE

Security experts agree that the most plausible worst-case scenario would be an attack on national critical infrastructure. Elad Sharf, security research manager at Performanta, suggests the "zero-day worm" would likely be the weapon of choice.

The rapid distribution capability of a worm, when combined with the unknown impact of a zero-day attack, could potentially be devastating. We've seen it before with Conficker, a worm that infected seven million machines within a year of launch in 2008 and still resides on an estimated one million of them today. "Despite research demonstrating that the Conficker virus didn't have an end-goal or specific purpose, it still caused havoc, including causing fighter planes to be grounded and infecting military systems, including 75% of the Royal Navy fleet," said Sharf. "The worst-case scenario for a zero-day worm is extreme: it could rapidly disable vast swathes of military and civilian infrastructure... as a prelude to even greater tragedy."

Zero-day worms could infect industrial control systems, known as SCADA (supervisory control and data acquisition). SCADA sits at the heart of almost everything, be it a nuclear power plant, water-treatment plant or system controlling traffic flow.



States have already performed SCADA attacks, such as an alleged joint US-Israeli strike against the Natanz uranium-enrichment plant in Iran using the Stuxnet worm, with a payload of four zero-day exploits. The attack, which has never officially been confirmed, sabotaged Iran's nuclear programme by destroying the centrifuges used for separating nuclear material. By attacking its SCADA systems, enough damage was done to shut down the plant. The plant systems were even air-gapped – not connected to the outside internet or networks – but the worm still managed to infect them, most likely via contractors with USB drives. Stuxnet was a targeted attack, with a very narrow focus. Imagine how much damage could be done if an attack was broadened. "If you were working with other malicious actors, and putting together a co-ordinated effort, you can probably disrupt multiple services in small and medium-sized countries," warned Stephen Coty, chief security evangelist at Alert Logic.

If an attack on the power grid, for example, lasted several days and led to blackouts, you could easily envisage looting and violence. Or what about, as Elad Sharf suggests, "if a hospital was hacked and its patient records destroyed?" Worse yet, "this type of attack cannot be 100% prevented: a zero-day worm can take control of any computer on the network, and the impact is exponential".

2 SELF-CRASHING CARS

Not every expert is convinced that cybergeddon can be delivered by a worm, mainly because defences have been hardened to mitigate against them. "Most systems have default-deny firewalls... limiting the attack surface to write a worm for," said 451 Research senior security analyst Adrian Sanabria.

So what keeps him awake at night? "What would scare the hell out of me is if someone managed to hijack system-update mechanisms," he said.

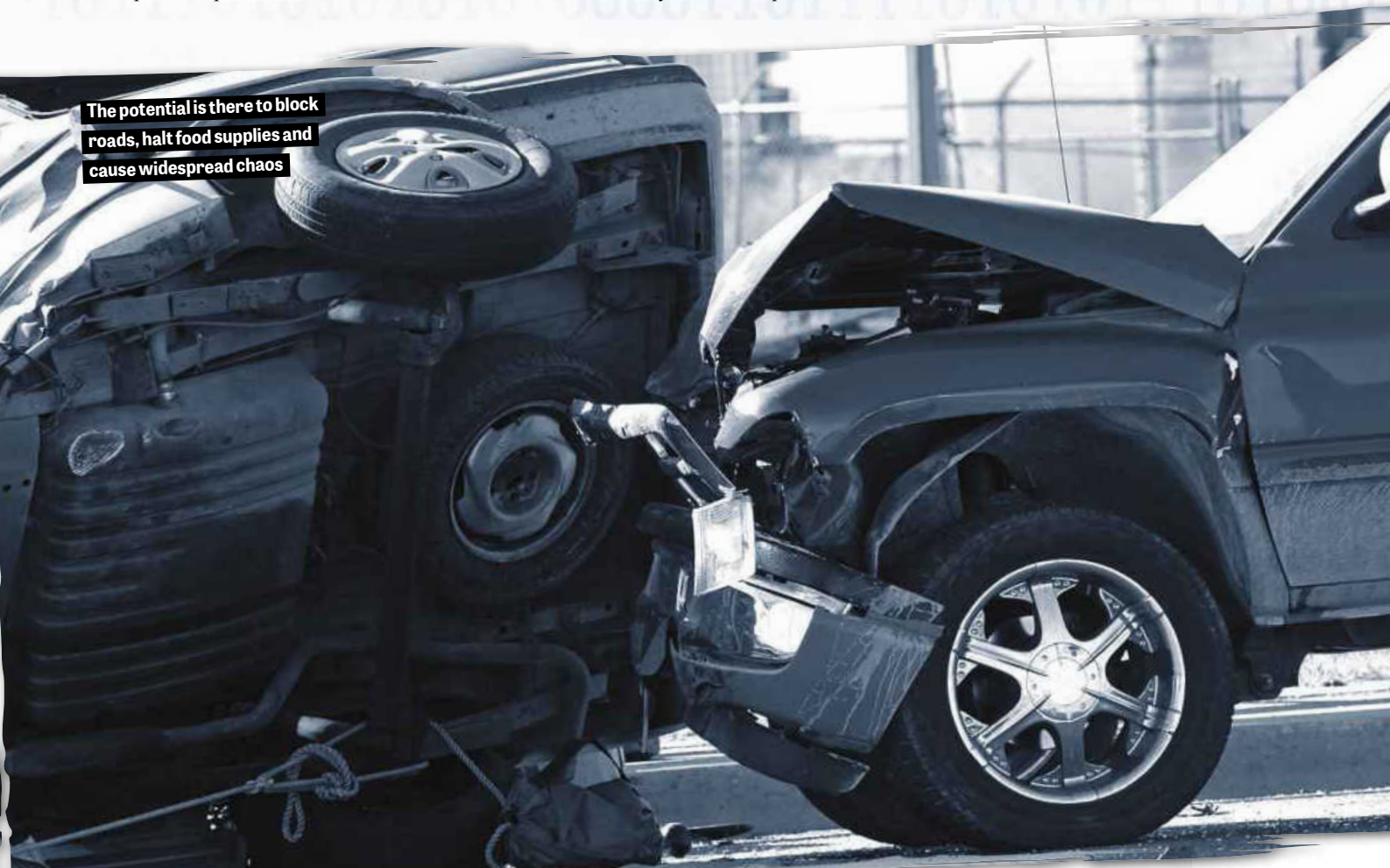
"WHAT IF, IN 20 YEARS, MOST OF US ARE USING COMPUTER-ASSISTED DRIVING THAT'S VULNERABLE TO REMOTE COMPROMISE?"

"Whether Windows, Mac, Android, IOS [or] IoT devices, nearly anything that runs updatable software nowadays has an update mechanism that allows for patches or new firmware versions to be sent out. This makes writing a worm completely unnecessary, because if this mechanism can be leveraged to send out a malicious update, millions of devices could be effectively compromised in a very short timespan."

What if such an attack targeted integrated software controlling pressure in water or gas pipelines? Obviously, there are massive benefits in fixing issues overnight from a central source, but that also paints a big target on the update system. Sanabria actually discovered such a flaw in some cloud-managed wireless access points that could be updated without any real authentication. Owning one access point made it possible to infiltrate the configuration for all of them, with the help of a small Python script.

When Charlie Miller and Chris Valasek discovered flaws in GM vehicles, they were in a position to sabotage over a million cars using a similar Python script. That's why Robert Hansen, VP of WhiteHat Security Labs, fears for the future: "What if, in another 20 years, most of us are using self-driving or computer-assisted driving that's vulnerable to remote compromise? What if, during peak rush-hour time, every single one of them suddenly made an extremely rapid turn?" The potential is certainly there to block roads, halt food supplies and cause widespread chaos. "Most cities are food islands, which means they don't grow enough food within the city to sustain the population," Hansen explained. "After a few days of no food, a certain percentage of the population would begin turning on itself."

The potential is there to block roads, halt food supplies and cause widespread chaos





FORGET THE FUD

There has always been plenty of fear, uncertainty and doubt (FUD) in the IT security world. There are plenty of scary stories in the media that, in reality, shouldn't get you running for the survival handbook. We asked our experts to pick three...



"Aeroplane hacks through media systems that allow you to monitor

the traffic of customers of the flight. Getting access to the root system, and therefore control of the aircraft, would require physical access."

STEPHEN COTY, CHIEF SECURITY EVANGELIST AT ALERT LOGIC



"Crimeware toolkits are designed to steal information, but there's

a limit to how much damage these threats can achieve. Given their goals and focus, they don't really have the capacity to qualify as a catastrophe."

ELAD SHARF, SECURITY RESEARCH MANAGER AT PERFORMANTA



"I'm really not worried about fitness trackers and smartwatches, or

hackers stealing my biometric data. I'm more worried about transportation, utilities and the big stuff more likely to draw the attention of attackers with both the skills and motivation to carry out our biggest fears."

ADRIAN SANABRIA, SENIOR SECURITY ANALYST AT 451 RESEARCH

The impact of a major attack on the financial sector would be felt instantly



3 BANK RAIDS

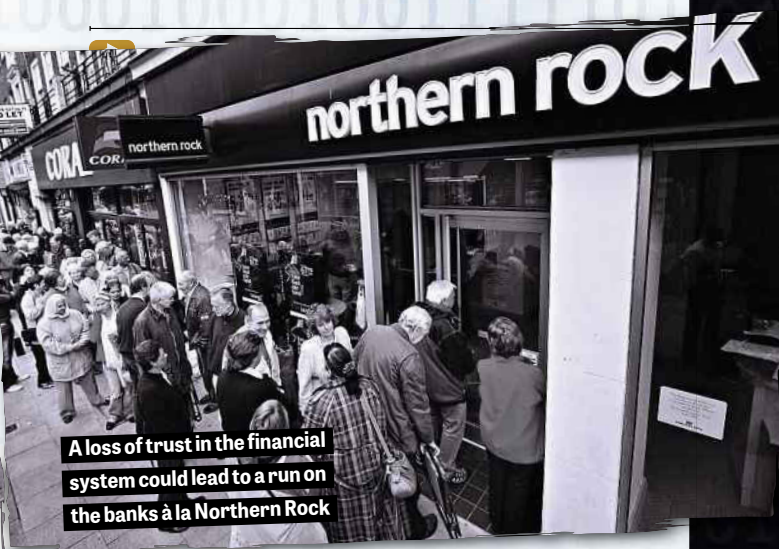
Governments are always identifying, classifying and securing what they consider to be critical national infrastructure. In the UK, it's described as "those infrastructure assets (physical or electronic) that are vital to the continued delivery and integrity of the essential services upon which the UK relies, the loss or compromise of which would lead to severe economic or social consequences or to loss of life". We can only speculate on the individual sites, as they're classified to avoid making them targets, but the frequently attacked financial sector is almost certainly on that list. So far, most of the attacks targeting this sector have been for financial gain, but someone will "be tempted at one point to perform a real-life re-enactment of Mr Robot's plot to destroy all digital records of a major financial institution", warned George Chiorescu-Petre, security consultant at AVR International.

According to Chiorescu-Petre, the impact would be felt instantly. "The first immediate effect would be the inability to perform transactions as the systems would be taken offline,"

he told us. "The whole economy can be impacted if companies and people are unable to perform payments." The second effect would be a loss of trust in the financial system, which can lead to a run on the banks, as seen after the Northern Rock collapse. This destabilisation of the economy can quickly lead to political unrest, and regime change often follows.

It could also be scarily easy to unleash a fintech attack, according to Rickey Gevers, CIO of RedSocks. He believes a Border Gateway Protocol (BGP) hijack would be the most likely form of attack. "Anyone with BGP access who is capable of altering BGP tables is able to control the flow of internet packets," he said. "They can determine where packets are going and which route they will take." That could make it possible to shut down all the payments systems in a country. Secure BGP on a global level was proposed back in the 2000s, but wasn't implemented "as people were too afraid that switching to this protocol would cause an outage of their clients' current internet connections," according to Gevers.





A loss of trust in the financial system could lead to a run on the banks à la Northern Rock

4 THE DEATH OF CRYPTO

Image: Peter Macdiarmid

The most likely cause of cybergeddon will almost certainly be something that hasn't occurred yet. After all, there's a huge amount of resources going into preventing the obvious. The unknown is, by definition, hard to predict. Unless you are Guillaume Lovet, threat response manager at Fortinet, that is.

Lovet thinks that the scenario that will change our lives is the proving of the Riemann hypothesis. This is a conjecture that implies results about the distribution of prime numbers, which, if proven, would undermine the basis of asymmetric cryptography. "Modern cryptography completely relies on some unproven mathematical observations," Lovet explained. "Such as the fact that when you count, prime numbers seem to occur unpredictably." Prove that they don't, and more importantly how they don't, then concepts such as authentication, confidentiality and anonymity on the internet go to pot, with few alternatives in the short term. "That means that suddenly man-in-the-middle attacks cannot be prevented anymore."

Anyone could intercept and modify sent data. "Think about the implication in terms of e-commerce, banking and authentication to critical systems," Lovet added. "Now think how much our economy depends on all that today, and even more so tomorrow, with the probable 'Uberisation' of many sectors."

Mathematical breakthroughs undermining modern cryptography would also have consequences for cryptocurrencies and blockchain technology. It would create a total loss of anonymity and privacy, and set back our ability to communicate with any confidence online. And that includes internet service providers and hosts, who would no longer be able to secure traffic to and from their networks. The world might not come to an end but, for a while at least, it would be a whole lot less secure.

5 REBOOT FAILURE

The US National Oceanic and Atmospheric Administration (NOAA) is a federal agency that, among other things, provides official space weather alerts, courtesy of its Space Weather Prediction Center in Colorado. If you're wondering what this has to do with a potential cybergeddon scenario, Ian Trump the security lead at LogicNow, said that's precisely the problem. "Imagine we started with just three-and-a-half days left before our lives were in for a sudden and drastic change," he said. "Maybe it was because of the endless loops of terrorist attacks and environmental disaster news that the alert from the Space Weather Forecast Center was neglected."

The hypothetical alert would be a warning of catastrophic impact due to coronal-hole high-speed stream activity, directly targeting Earth. In other words, a coronal mass ejection (CME) that would cause massive electromagnetic disruption on a scale no single EMP weapon could ever achieve. A CME is a colossal burst of gas and magnetic field from the solar corona that ejects into the solar wind. "It would be hard to accept the idea that our sun was about to switch the power off globally," Trump continued. "Forget an elite group of glove-wearing, black-hoodied hackers causing cyber-armageddon, a far more likely scenario is a coronal mass ejection of such magnitude that it disrupts, degrades and destroys not only IT systems, but the lifeblood of those systems. Without it, our way of life shuts down. And by down I don't just mean Bluetooth-enabled selfie sticks are no longer working, I mean seriously down."

Ambassador Woolsey and Trump may be right about EMP and CME, but we won't be taken completely by surprise as researchers at NOAA and elsewhere will warn us to shut things down to prevent irreparable damage. Assuming we take any notice, of course. "The bushy haired, fashion-challenged scientists will tell us to stay indoors; brace ourselves and actually be thankful," Trump

said, reminding us that having switched everything off (and that means everything: IT systems, trains, planes, automobiles and power plants), we have to switch everything back on again. "A global shutdown and reboot is not without its complications. As many an IT admin or MSP knows, shutting down is the easy part - it's turning everything back on again that can become the problem."

There are systems required for survival - such as life-support, refrigeration, defence and emergency services - which have never been turned off, meaning there's no surefire way of knowing or predicting how CPUs, hard drives and memory chips that have been running for a decade or more will come back to life. "If we can't get power plants back online, Facebook and Twitter may be the least of our worries," Trump concluded. "With any mass event, the criminal element, cyber and otherwise, will seek to exploit the situation, before, during and after. We must all be vigilant, and governments and society will need to work together to reduce the impact of a global shutdown."

"FORGET A GROUP OF HACKERS CAUSING CYBERGEDDON, A FAR MORE LIKELY SCENARIO IS A CORONAL MASS EJECTION"

A coronal mass ejection would disrupt, degrade and destroy IT systems



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Make publishing quick and easy

Our bonus software this month is Serif PagePlus X4. **Nik Rawlinson** reveals how to make the most of this powerful publishing tool



This month's bonus software downloads include the excellent PagePlus X4, Serif's powerful desktop publishing application for Windows (including Windows 10). While it might not have usurped Adobe InDesign in the nation's magazine production offices, there's no reason why it shouldn't: it has all the tools required to design and output professional-grade publications easily and quickly.

Over the next three pages, we'll walk through the process of laying out a one-page publication and introduce all of the key tools you'll need to get started.

General principles

If you've used a desktop publishing (DTP) tool before, you'll already be familiar with many of the key concepts involved. If not, keep one thing in mind: it's all about frames.

The layout is entirely free-form, meaning the software needs to know exactly where to place things without reference to the rigid margins and lines that you might see in, say, Microsoft Word. While you can simply click and type anywhere on the page, you should get into the habit of dragging out a text frame

before you enter anything into it, as we'll show you. Text wraps at the edges of the frame, rather than the edges of the page.

Images are different, as they can be larger than the frame in which they're placed, with the edges cropping off any surplus pixels. This is a boon for busy designers because they can drop images into a document and tweak them on the page, without having to first crop them in a photo editor.

As a rule of thumb, only choose a maximum of two fonts – one for headlines and one for the copy

Good typography

It's very tempting when laying out a poster or flyer to use too many fonts, often in a misguided attempt to catch the reader's eye. However, the result can be precisely the opposite, making the document unappealing and difficult to read. As a rule of thumb, choose a maximum of two fonts – one for headlines and one for your main copy –

and vary their emphasis (italics, bold and underline) and size to highlight specific points you want to get across.

If you need to go further, perhaps because you want to add a panel to the side of a text column, consider applying a very subtle background colour, or heavier borders to the top and bottom of the frame. You should also remember that larger text isn't necessarily easier to read. A common mistake made by less experienced designers is to bump up the text size rather than the line height, when doing just the opposite – increasing the gap between each line while leaving the text size the same – is often more effective, allowing you to fill large spaces without the reader feeling like they are being patronised.

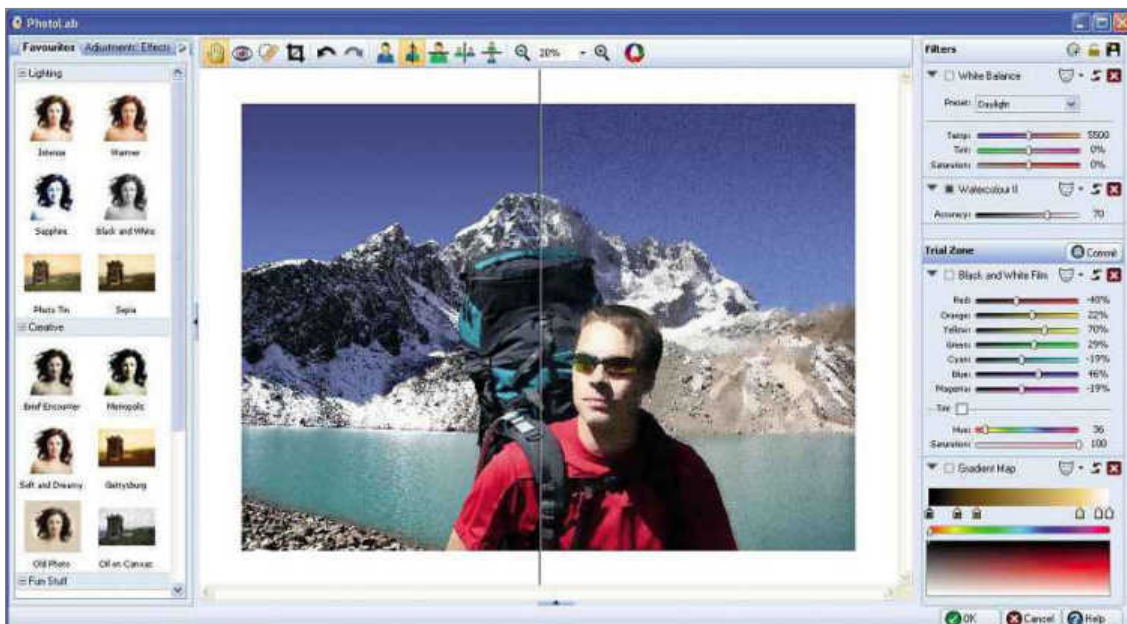
Create libraries

Finally, remember that consistency is key. Flick through the pages of, for example, *PC Pro* and you'll notice that, while the layouts differ greatly between the news, reviews, features and opinion columns, a consistent use of colours, fonts and page furniture (graphical elements, such as slugs at the

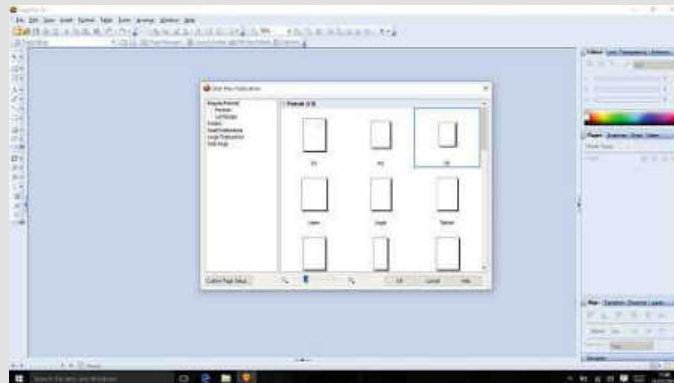
top of a page, that help to define the different parts of each layout) binds them together and makes each piece of editorial copy feel like it belongs to the greater whole.

Do the same while working in PagePlus by saving your theme colours and text styles in the palettes – we'll show you how to do this – and by defining underlying layouts that can be quickly applied as the basis of every new page in your document.

LEFT The bundled PhotoLab offers more adjustment options than many specialist editors

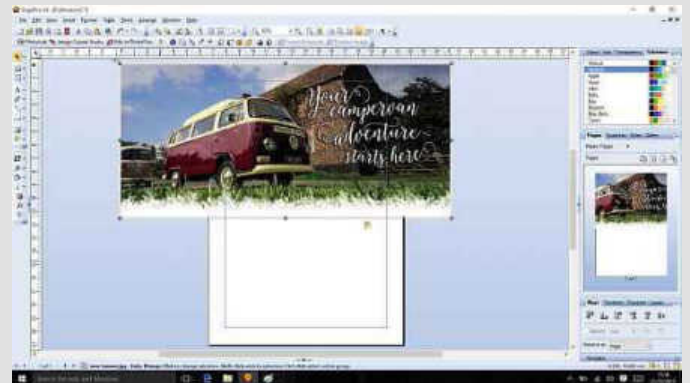


Creating a simple publication in Serif PagePlus X4



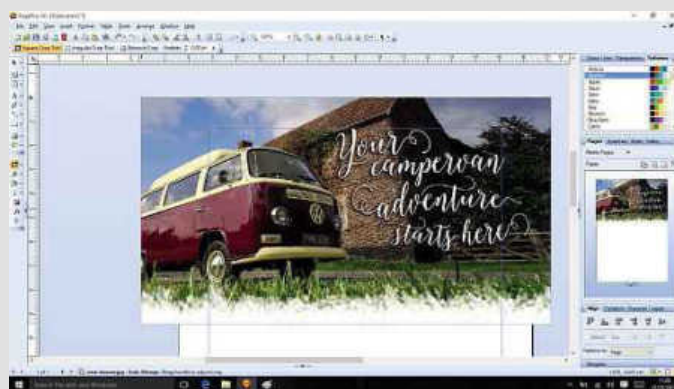
1 DEFINE YOUR DOCUMENT

We're going to create a flyer for a camper van hire business. This will work best at A5, as it can easily be slipped into magazines, put through doors or tucked under car windscreen wipers. Select A5 from the New Publication dialog. It's also worth looking at the other options in this panel. For example, folded books would be great for short-run publications.



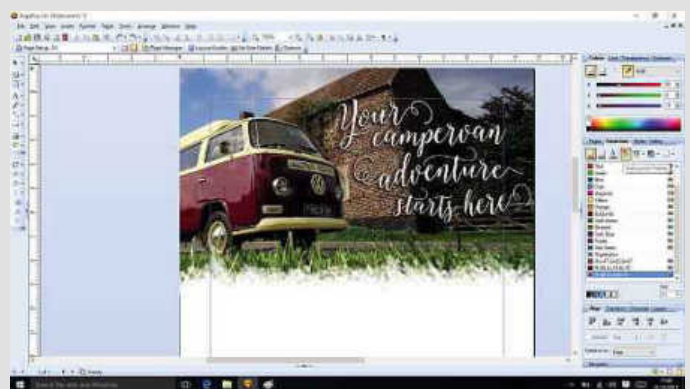
2 ADD AN IMAGE

People notice pictures before they start reading text, so we're going to put a large picture at the top to catch our audience's eye. Pressing Ctrl+G opens the picture browser, double-clicking selects the picture and clicking on the page places it. Dragging the handles on the corners and edges of the frame lets us resize it to fit the space.



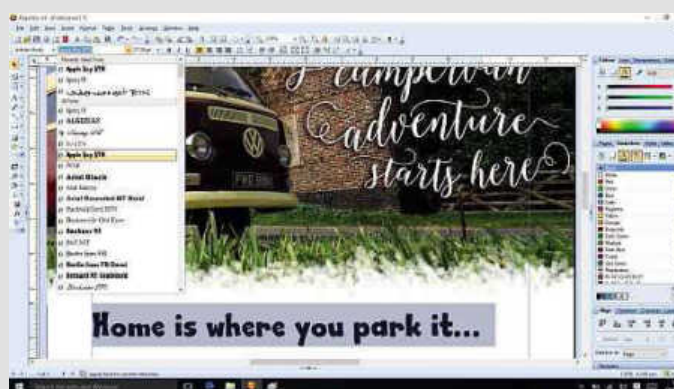
3 CROP THE IMAGE

Our picture is still too wide for the page, meaning it will be cropped when we print it (as shown in the right-hand sidebar). To neaten it, click the crop tool (in the left-hand toolbar) and resize the frame without changing the image size. The pixels outside the frame are no longer visible, but we can drag the image to show a different area within the frame.



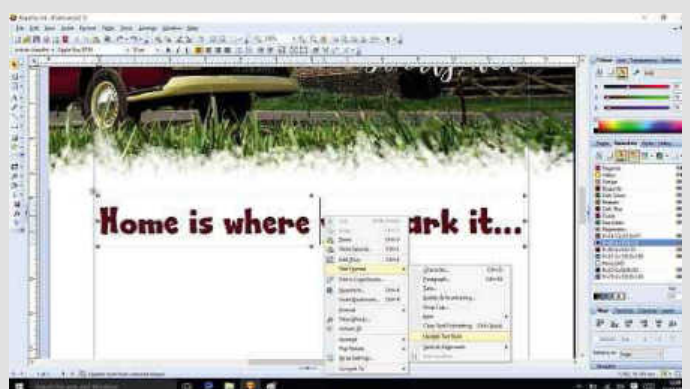
4 CHOOSE YOUR COLOURS

We can now use the image as the basis of our overall colour scheme. We'll use the purple of the camper van and the blue of the sky. Select the eyedropper in the Colour palette and click on a purple area, then click the fourth button at the top of the Swatches palette to open the Publication Palette. The colour has been added to the list. Repeat this for the blue.



5 ADD A HEADING

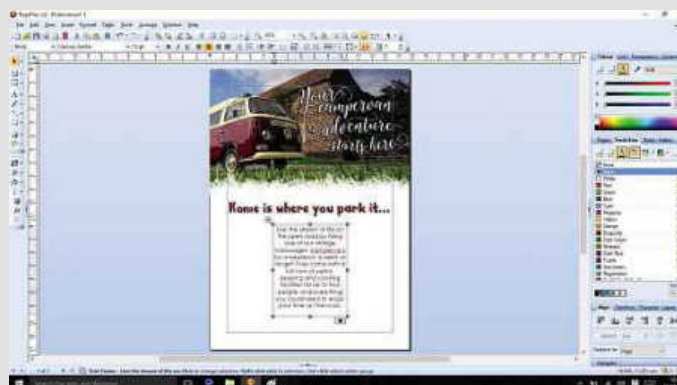
We need an enticing heading such as "Home is where you park it...". Add it by picking the Artistic Text tool from the toolbox's second section and dragging out a text frame. It's in Times New Roman by default, but this is too business-like. By rolling over the fonts in the dropdown menu, we can preview other options. Select the playful and clear Apple Boy BTN.



6 TAILOR THE FONT

We can save the font for future use by right-clicking the text and selecting Text Format | Update Text Style, which will change the default, or we can pick Format | Text Style Palette and create a new text style based on these settings. Saving text styles means we can apply them to other text later by picking them from the style toolbar.

Creating a simple publication in Serif PagePlus X4



7 ADD BODY COPY

Now we add the main text of our flyer by clicking the Text Frame tool (second down in the toolbox), dragging out a text frame and either typing or pasting the content into it. Clicking the arrow beside the tool lets us select a range of frame shapes, but we're sticking to a rectangle. We've created a thin column so we can put images to either side.



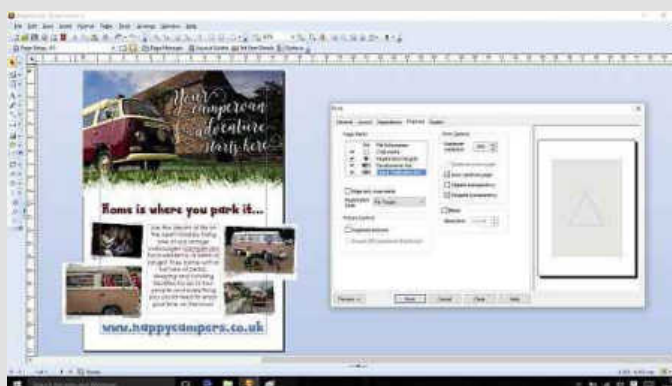
8 RECYCLING TEXT STYLES

We need to add a web address, which will use the same text style as the heading. Type the address into a new Artistic Text box, before selecting our previously defined Artistic Headline from the dropdown. We've also used the saved sky-blue shade from the Publication Palette for the web address.



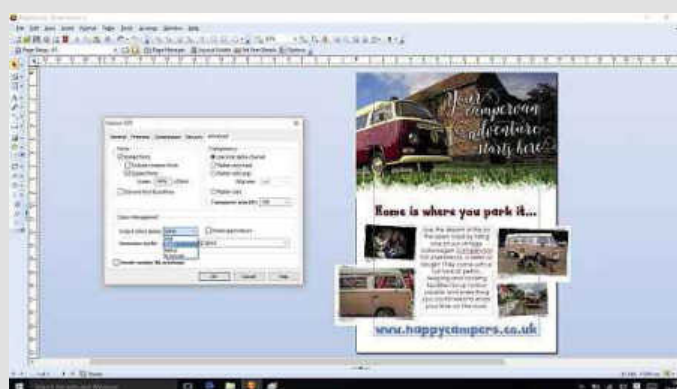
9 LAYOUT HELPERS

We've placed four images around the body copy and want to make sure they're neatly lined up. Selecting the images and picking "Align Objects" from the Arrange menu specifies whether the sides or centres are aligned vertically or horizontally, meaning we don't have to drag everything into place. Select "Group Objects" to keep the images together.



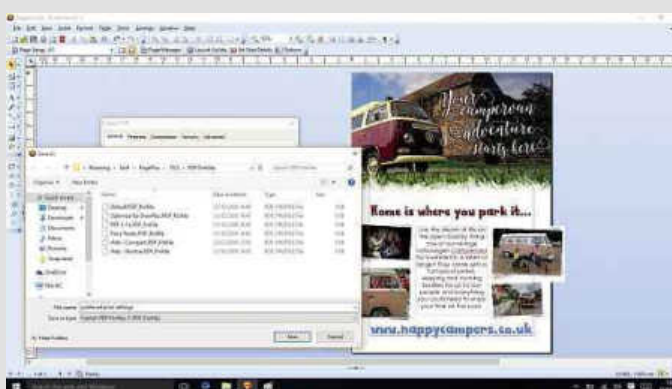
10 PREVIEW PRINT

Our flyer is finished, but we want to create a test print before sending the file to be professionally printed. Picking Print from the File menu and switching to the Prepress tab activates crop marks, registration targets and colour bars, allowing us to preview the points at which the commercial printer will trim the page after printing the flyer.



11 PROCESS FOR COMMERCIAL PRINTING

We can now send the flyer to a printer as a PDF. Do this by picking "Publish as PDF..." from the File menu. Switch to the Prepress tab and activate the crop and registration options, then switch to Advanced and set the Output Colour Space to CMYK. On the Compression tab, click Best Quality, and downsample colour and greyscale images to 300.



12 SAVE YOUR SETTINGS, SAVE YOUR FILE

These settings should be good for most commercial print jobs, so switch back to the General tab, click "Save As..." and give them a name. We can now use them in the future. Clicking OK on the original dialog outputs our flyer as a PDF that's suitable for commercial production. We can now save our work as a PagePlus Publication, or as a template. ●



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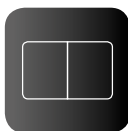


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Efficient processors and sleek laptops are all very well, but for hardcore work you need a truly powerful system. We put a selection of workstations and high-end PCs through a blaze of demanding tests.

FEATURES



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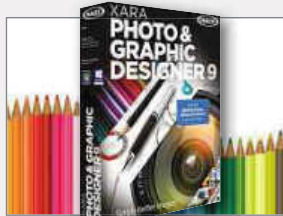
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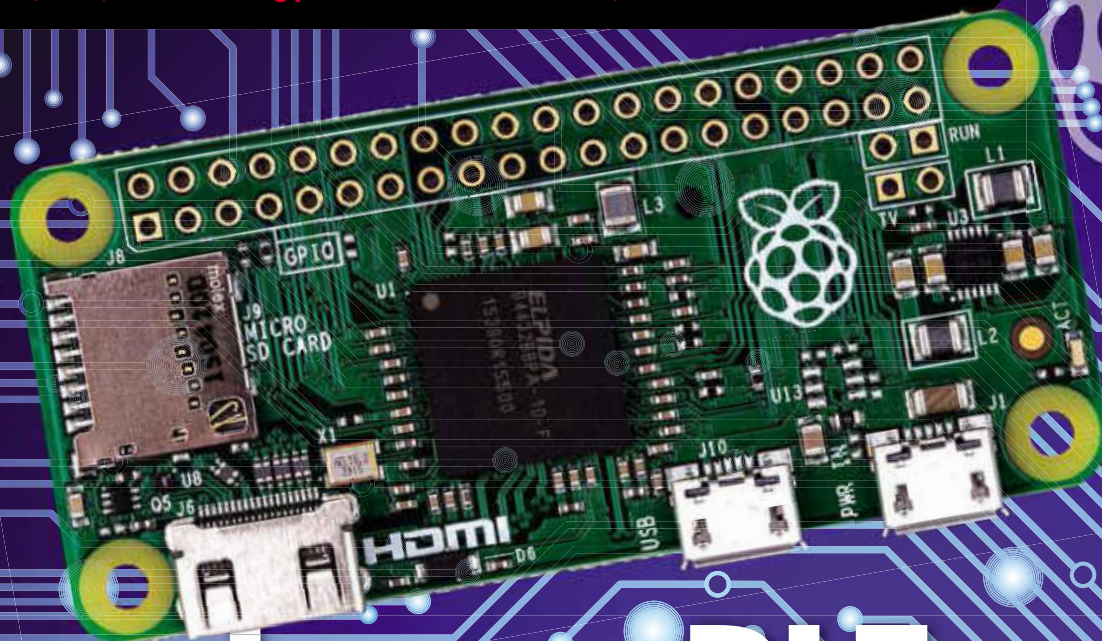
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Raspberry Pi Zero

An insanely cheap, insanely tiny computer that might be perfect for your projects – if you can find one to buy

SCORE ★★★★★

PRICE £3 (£4 inc VAT) from
element14.com

When the original Raspberry Pi Model B launched in February 2012, it made an immediate impact. Demand knocked major vendors' websites offline, while developers of single-board computers that had previously felt comfortable asking triple figures for their wares found themselves having to compete with a board costing far less.

The surprise launch of the Raspberry Pi Zero in late 2015 echoed the excitement that surrounded the original, with one major difference: while the original cost around £30, the new Pi Zero is only £4 – a price that saw the device become the first computer in history to be cover mounted on a magazine (although sadly not this one... yet).

Naturally, corners have been cut to reach such a price. Is the Pi Zero truly a herald of the next generation of ultra-affordable, ubiquitous computing or, as its critics would have it, simply a promotional stunt?

■ Specifications

Without knowing anything else about the Pi Zero, it's easy to become disillusioned by the specifications. Compared with the Raspberry Pi 2 Model B, it's definitely a backwards step. The new Broadcom BCM2836 quad-core processor, with its modern ARM v7 instruction set, has been replaced by the long-outdated

BCM2835 ARM v6 single-core chip of its predecessors, albeit now running at a stock speed of 1GHz, a 300MHz boost over the original's 700MHz.

"Is the Pi Zero truly a herald of the next generation of ultra-affordable computing or, as its critics would have it, simply a stunt?"

BELOW There are only three ports: one mini HDMI, one for power, and a USB On-The-Go

The Pi Zero wasn't built as a rival to the Raspberry Pi 2, though. It's designed to offer an alternative to the Raspberry Pi Model A+. Here it compares more favourably, thanks to that processor speed tweak and a doubling of the RAM to 512MB. Both lack a network port.

Areas have still been sliced to reach that £4 price point, even compared with the Model A+. The camera (CSI)



and display (DSI) interface ports have gone, as has the analogue audio output. Composite video support is still there, but you'll need to solder on a header yourself if you want to use it.

Layout

The specifications tell one story, but the layout of the board itself tells another. The Raspberry Pi Zero is a major feat of engineering, packing most of the same features of the Model A+ into a footprint barely half the size and a fraction of the weight.

For those looking to use the Pi Zero in a hardware project, these are positives, as is a meaner power draw thanks to fewer components. For those new to the Pi ecosystem, the decision to leave the usual 40-pin general purpose input/output (GPIO) header unpopulated will be an annoyance, although it is one readily solved with a soldering iron and a steady hand. More accomplished users, however, may see the ability to connect only the pins they require as an advantage.

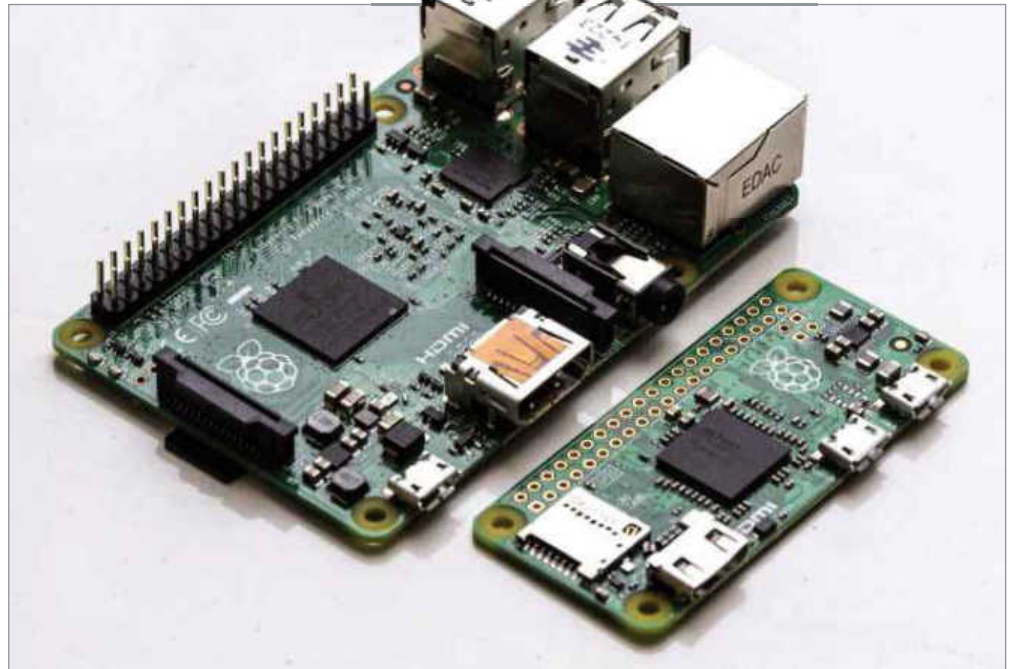
The size of the Pi Zero is undeniably eye-catching, but it does come at a cost. Rather than the full-size HDMI port of the rest of the Raspberry Pi family, the Pi Zero has the less common mini variant. Likewise, the USB port of the Model A+ is lost in favour of a micro-USB OTG (On-The-Go) port, requiring an adapter to use any full-sized USB device.

Performance

When you've tracked down adapters for the Pi Zero's mini-HDMI and micro-USB ports, booting the Pi Zero is a familiar experience. With no operating system provided, it's up to you to supply a microSD card loaded with a compatible OS. Typically, this would be the popular Raspbian Linux distribution. Unfortunately, options such as Windows 10 and Ubuntu are off the table owing to the Pi Zero's ageing processor.

For someone used to the Raspberry Pi 2's quad-core processor, moving to the Pi Zero feels restrictive. The boot time is considerably lengthened and the benchmarks clearly show the lack of power. The cross-platform SysBench suite completed a CPU test in 358.47 seconds, a result that's significantly slower than the 74.48 seconds of a Raspberry Pi 2.

Switch the comparison to the Model A+ or B+, though, and the Raspberry Pi Zero's new 1GHz clock-speed becomes apparent: both full-size models completed the same test in 500 seconds, or 140 seconds slower than the Raspberry Pi Zero. It's relatively fast, but no more.



How much does it cost and where can I get one?

With the ability to outperform single-board computers five times its price, the Pi Zero certainly looks good, but there's one fly in the ointment: availability. The Pi Zero's price has been set by the Foundation at £4, making it an undeniable bargain, even if you need to pick up adapter cables, the GPIO header, microSD card and a power supply separately.

Sadly, there are plenty of bargain-hunters out there. The minute stock appears at one of the official outlets, it immediately sells out again. Almost two months since its launch, the Pi Zero is still difficult to pin down.

That leaves room for a black market of sorts. When the device was bundled on the cover of *The MagPi*, the Foundation's official magazine, copies appeared on auction sites for anything up to £100.

Even now, some otherwise reputable retailers are marking the device up to ridiculous levels: one is selling the device for £36, albeit with

ABOVE We thought the Raspberry Pi 2 was small until the Pi Zero landed

mini-HDMI and micro-USB adapters to the value of £2 included. At £4, the Pi Zero is a bargain. At £36, the Raspberry Pi 2 is a much better choice for anyone not constrained by size limitations.

Verdict

It's easy to concentrate on the negatives of the Pi Zero, and there certainly are more than one. The processor is a step backwards, the loss of camera and display interfaces will

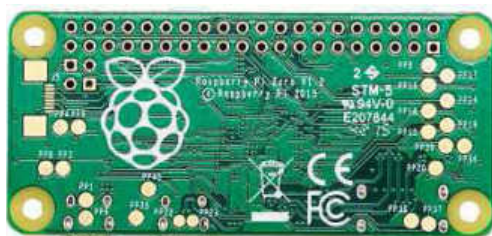
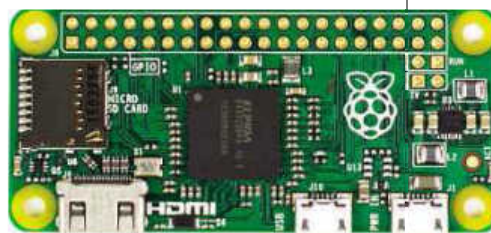
"To be able to build a device that can hold its own with the Model A+ and sell it for just £4 is phenomenal and saves money for extras"

hurt many embedded projects, and the need to solder your own GPIO header will make newcomers nervous.

Perhaps the biggest hurdle to the Pi Zero's success is availability,

which remains poor. It's a problem the Foundation is working hard to resolve, but is a real annoyance.

The price, however, is what saves the Raspberry Pi Zero from disappointment. To build a device that can hold its own with the Model A+ and sell it for only £4 is phenomenal, and it leaves plenty of room in the budget for the adapter cables and extras required to get it running – even a USB Ethernet or Wi-Fi adapter for projects that need network connectivity. If you see the Raspberry Pi Zero on sale at £4 anywhere, snap one up. It's one amazing bargain. **GARETH HALFACREE**



ABOVE & LEFT Actual size: the front and rear of the Raspberry Pi Zero

SPECIFICATIONS

Single-core 1GHz Broadcom BCM2835 (ARM v6) processor • Broadcom VideoCore-IV graphics • 512MB RAM • USB 2 OTG • microSDHC card reader • mini HDMI port • 40-pin GPIO connector • 5.45 x 65 x 31.4mm (WDH) • 1yr RTB warranty



Dell XPS 15

With quad-core Skylake CPUs, Nvidia graphics and a 4K display, Dell has created a monster 15.6in laptop

SCORE ★★★★★

PRICE £1,374 (£1,649 inc VAT) from
dell.co.uk

Dell has scaled up the elegant carbon-fibre and metal design of the XPS 13 to create the company's most stylish 15in laptop yet. Throw in the latest quad-core Skylake processors, Nvidia graphics and the option of blazingly quick NVMe SSDs, and the Dell XPS 15 is ready to do serious damage to your credit card.

Squared-off slabs of cool-to-the-touch metal sandwich a thin wedge of carbon fibre; long rubber feet poke through the underside; and the clean, crisp design is all straight-line geometry and subtle curves. The XPS 15 is one handsome devil.

Tilt back the lid, and there are only a few millimetres of bezel framing the Dell's 15.6in display. This not only looks great, but it also means the Dell XPS 15 is smaller than laptops with similarly sized screens.

It's a couple of millimetres thinner even than the equivalent MacBook Pro, and 12mm less deep. If you want a larger laptop with the smallest possible footprint, then the XPS 15 emphatically ticks that box. It's not too heavy, either, at 2kg on its own and 2.34kg with the charger.

What's most impressive, though, is that Dell has made a beautiful laptop without compromising on the essentials. The backlit keyboard provides just enough key travel and feedback to make for comfortable typing, with no cramped cursor keys or layout issues to sour the deal, and the touchscreen feels superbly

responsive, with a layer of Gorilla Glass 3 providing a smooth feel for prods and gestures.

I like the buttonless touchpad. I found myself quickly acclimatising to its solid clicks and range of multi-finger gestures with few annoyances or frustrations.

More ports, please

As ever, connectivity is sacrificed at the altar of slender loveliness. Dell has equipped the XPS 15 with a pair of USB 3 ports, a USB 3.1 Gen 2 Type-C port (which doubles as a 40Gbits/sec Thunderbolt 3 connection), an SD card reader, a 3.5mm headset jack, and an HDMI 1.4 port.

This roster of ports might be ample for a 13in Ultrabook, but it does seem a touch stingy here. I'd want at least another USB 3 port, maybe even a couple of USB Type-C ports for good measure. But, while Dell has also dumped Ethernet by the wayside, there is at least a glimmer of sense in its decision to employ a quick 3x3-stream Broadcom 802.11ac Wi-Fi adapter. With the right router, you can connect at link speeds of up to 1,300Mbps/sec, which is fast by any measure. In slightly less exciting news, Bluetooth 4.1 is also supported.

There's not much else to get excited about. The presence of Dell's one-touch battery meter is welcome – press a button, and five LEDs indicate remaining capacity – but pulses are left at a resting tempo by the 720p webcam. It's okay, but I wish manufacturers would equip high-end laptops with image sensors to match.

The XPS 15 has a decent set of speakers hidden away inside.

ABOVE Only a few millimetres of bezel surround the XPS 15's display



"I even like the buttonless touchpad and found myself acclimatising to its solid clicks and range of multi-finger gestures"

Crank them up, and switch the Waves MaxxAudio Pro app to its

Music setting, and the result is superior audio quality with music, movie and game soundtracks to most laptops I've encountered.

Display of brilliance

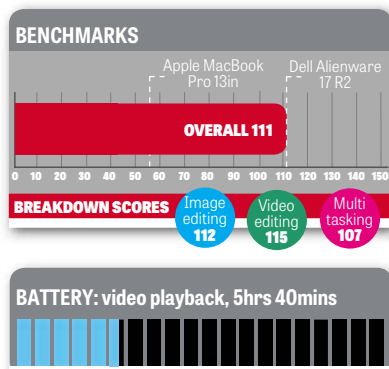
While the £1,099 Dell XPS 15 makes do with a Full HD non-touch display, the pricier models in the line-up – including the model Dell sent us for review – add a 4K, 3,840 x 2,160 touchscreen to the laptop's list of talents. Suffice to say, everything looks razor-sharp, and it hits all the right notes.

The glossy layer of Gorilla Glass 3 across the display might not be to everyone's taste, but it does give images a tremendously vibrant,

punch. While skulking through the darkened corridors of *Metro: Last Light*, the Dell's 4K display picked out a huge amount of detail while delivering deep, inky black. It's superb.

Brightness rises up to a respectable 363cd/m², contrast 1,065:1 and it covers an impressive 99.3% of the Adobe RGB gamut. The best news of all, though, is that Dell has done away with the dynamic contrast feature it forced on the XPS 13. Brightness remains stable regardless of what you're viewing onscreen, which is good news for those looking to use the XPS 15 for reliable photo- and video-editing duties.

The display's ability to reproduce a huge palette of colours means onscreen colours often look overly





intense, which is a common issue with wide-gamut displays, but Dell's PremierColor app aims to counter that by allowing users to swap between a range of display modes including sRGB, Adobe RGB, Rec. 601 (the standard for SD video), Rec. 709 (HD video) and Rec. 2020 (4K video).

Sadly, however, barring some obvious brightness shifts, neither my eyes nor our X-Rite colorimeter could discern much difference between the various modes, which suggests there may be a software issue. Certainly, if you were hoping to flick on sRGB mode and get a properly calibrated display to work with, that isn't currently an option.

On the bright side, the XPS 15's default display mode just so happens to be perfectly calibrated for the Adobe RGB spectrum, delivering a superbly low average Delta E of 1.48 – that's fantastic news for anyone working in colour-managed applications such as Photoshop.

■ Turn of pace

The XPS 15 ups the ante with Intel's quad-core Skylake processors, adds dedicated graphics in the guise of Nvidia's capable GeForce GTX 960M GPU and throws in superfast NVMe SSDs on the pricier models. There's also a choice of 8GB or 16GB of DDR4 memory. Dell hasn't cut any corners at all here.

The result is a laptop that feels brutally fast in pretty much every scenario. Press the power button, and Windows 10 is up and running in seconds. This is largely due to the NVMe Samsung PM851 SSD in our review unit: with sequential read

speeds of over 1,400MB/sec, it's obscenely fast.

The Skylake Core i7 in our review unit is the same 2.6GHz processor that's included in all but the cheapest XPS 15, and – to use a technical term – it's fast. In our demanding suite of image-processing, video-transcoding and multitasking benchmarks, the XPS 15 skipped through to a very respectable score of 111 – identical to Alienware's 3.8kg gaming laptop, the 17 R2.

Speaking of games, the XPS 15 is unusually capable when it comes to 3D gaming. Our current go-to benchmark is *Metro: Last Light*, and while it's no walkover, the Dell's GeForce GTX 960M and 2GB of GDDR5 memory are more than capable of doing it justice. Cranking the resolution up to 4K and lowering the detail to Medium provided a slightly stuttery, if utterly gorgeous-looking experience – frankly, it's hugely impressive that this laptop didn't immediately melt into a pile of hot metal and plastic.

It didn't take much fiddling to make *Metro: Last Light* completely playable: lowering the resolution to 2,048 x 1,152 provided a much sharper image than 1080p, while still sending average frame rates soaring past 60fps.

More impressive is the fact that the XPS 15 doesn't cook itself while working flat out. The fans spin up audibly, but after two hours of playing through *Metro: Last Light*, the GPU peaked at a maximum temperature of 85°C, while only one core of the CPU hit 88°C.

LEFT The Dell XPS 15 is even a couple of millimetres thinner than the equivalent MacBook Pro

Crucially, I observed no stuttering or throttling at all – the case felt warm to the touch, with a hot area above the keyboard's function keys, but this is nothing to worry about.

All that power-hungry hardware inside the Dell XPS 15 takes a pretty hefty toll on battery life, however. Despite a fairly large 84Wh battery (for comparison, the 15in Apple MacBook Pro has a 99Wh battery),

the XPS 15 only managed to survive 5hrs 40mins in our video-rundown test, and bear in mind that's with screen brightness dimmed to 170cd/m² and Wi-Fi switched off.

Frankly, I'd have expected a better result here. Anecdotally, there are several XPS 15 owners on Twitter reporting around six hours under normal use, so it seems like our tests are pretty much on the money. Stamina simply isn't one of the XPS 15's strong suits.

While we're on the subject of battery life, it's worth bearing in mind that the Full HD model comes with a significantly smaller 56Wh battery, meaning it may fare even worse than its pricier brethren.

■ Verdict

Aside from a handful of niggles, and the somewhat disappointing battery life, Dell should be patting itself on the back for delivering yet another top-notch Windows 10 laptop. The XPS 15 is powerful, portable and equipped with all the features anyone could ask of a high-end device.

Factor in the genuine gaming capabilities, and the XPS 15 could be very popular from the bedroom to the boardroom.

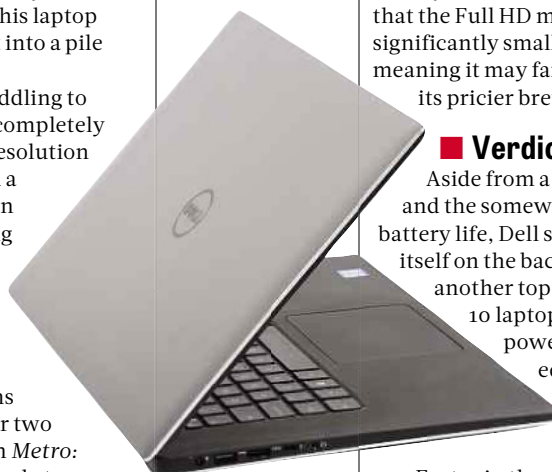
No, it's not cheap, especially not the £1,649 model on review, but this is exactly the kind of laptop that manufacturers need in their line-up if they're going to take the fight to Apple's dominant MacBook family. It's fast, gorgeous and multitasking: for me, this really is the do-it-all Windows laptop I've been waiting a decade for. **SASHA MULLER**

SPECIFICATIONS

Quad-core 2.6GHz Intel Core i7-6700HQ processor • 16GB RAM • 512GB SSD • 15.6in 3,840 x 2,160 IPS touchscreen • Nvidia GeForce GTX 960M graphics • 720p front camera • 802.11ac 3x3 Wi-Fi • Bluetooth 4.1 • SD slot • USB 3 • Thunderbolt • 1x HDMI 1.4 • 84Wh Li-ion battery • Windows 10 Home (64-bit) • 1yr next-business-day in-home warranty • 357 x 235 x 17mm (WDH) • 2kg

“The laptop feels brutally fast in pretty much every scenario: press the power button and Windows 10 is up and running in seconds”

BELOW The XPS 15 is a beautiful laptop with all of the essentials you would expect



LEFT The backlit keyboard provides enough key travel for comfortable typing





Lenovo Yoga 700 (11.6in)

A great design, but if you want an ultraportable with real firepower then look elsewhere

SCORE ★★☆☆

PRICE £458 (£549 inc VAT) from
lenovo.com/uk

While other PC makers have fiddled with their hybrid laptop/tablet designs, Lenovo has stuck rigidly to the Yoga principle since the dark days of Windows 8. Although rigid possibly isn't the right adjective: the Yoga's flexibility makes most laptops look more wooden than Jason Statham playing Hamlet. You can use it as a normal laptop, watch movies with it in "tent" mode (like an inverted "V"), or rotate the keyboard 180 degrees so it sits flush against the lid in "tablet" mode.

The downside of most previous Yogas is that, in the latter position, you're left with a very heavy tablet, but the 11.6in Yoga 700 weighs a much more manageable 1.1kg. It's no iPad Air – I found I needed to rest it against my legs when sat on the sofa – but if you want to switch between working and browsing, it's an excellent compromise.

The keyboard deactivates in tablet mode to avoid accidental button presses, but when you do need it, you should be satisfied. I'm a keyboard snob and didn't fall in love. There's a lack of travel, the keys feel a tad insubstantial and the single-height Enter key meant I hit the hash key above it irritatingly often. However, I was still able to reach decent typing speeds. Considering how compact the Yoga 700's design is, the touchpad is also a decent size and responsive in everyday use.

Nor did the display wow me. The thick bezel looks distinctly



old-fashioned compared with the best new ultraportables and makes the screen feel more cramped than it is. It's also ordinary when it comes to colour accuracy, with a slight yellow cast to white backgrounds and a relatively poor sRGB coverage of 61%.

However, this is when I needed to remind myself that this is a budget machine: despite costing £549, this IPS panel has a resolution of 1,920 x 1,080 pixels. That's to Lenovo's credit. It's also bright, registering 335cd/m² in our tests, while its contrast ratio is a respectable 744:1.

In practice, that means videos look decent – assuming you don't have any distracting overhead lighting because the screen is reflective – and it's helped by crisp, clear audio from the speakers. They are nothing special, but good and loud enough to fill a small living room.

The one thing you will find is that, if you push the Lenovo Yoga 700 with more demanding tasks, including watching video, the base tends to heat up. With no fans to keep things cool, it relies on the heatsinks and air vents on either side to shift the heat out and these aren't quite as efficient as a fan.

However, Intel's Core M3 range of processors is designed for power efficiency rather than firepower. This laptop has enough to be a casual user's main PC, but if you're the sort of person that likes to encode 4K video then look elsewhere. Indeed, heating problems caused it to struggle with our benchmarks, and only by allowing it to cool between the tests was I able to nurse it to a score of 19. Still, it's a touch faster than the Atom-powered Microsoft Surface 3.

To underline that this is a laptop for the undemanding user, rather than the enthusiast, it also struggled in gaming benchmarks. For instance, the *Dirt: Showdown* benchmark returned an unusable 13.9fps at 720p, High settings.

Finally to battery life, where I find myself in two minds. On the surface, a result of 6hrs 54mins in our video-rundown benchmark, which tallies with Lenovo's typical-usage claims of up to seven hours, is fine. Good, even.

But when you're getting Atom levels of performance, I'd hope for battery life of more than ten hours, and never forget that battery life

diminishes over the life of your device. As such, I can't get too excited by seven hours. It's decent, nothing more, and falls well short of the 11hrs 35mins delivered by the similarly priced Surface

3 (although do bear in mind that we ran the Surface 3 at a dimmer screen brightness level).

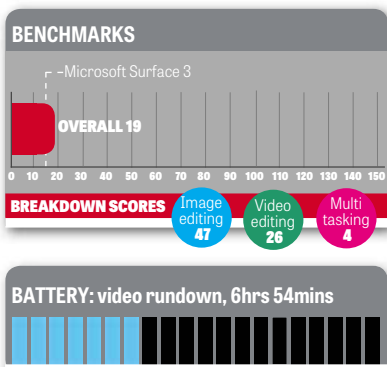
Handily, there is a little warning light that appears on the right-hand side of the Yoga if the battery is running low. From 100% to 20%, it's solid white, but dip below 20% and it turns amber. When it starts flashing, you're under 5% and it's time to find a power outlet.

Considering just how small this laptop is, there are a surprising number of buttons and ports. To continue our tour of the right-hand side, you'll find a backlit power button, volume/up down buttons, a combo mic/headphone jack, and a USB 2 socket.

There are also two tiny buttons that are difficult to press, but they

ABOVE Considering how small the laptop is, there are a good number of buttons and ports

"You can use it as a normal laptop, watch movies with it in 'tent' mode or rotate the keyboard 180 degrees for 'tablet' mode"





are potentially useful. One locks the screen to its current orientation, the other is indented and launches Lenovo's OneKey Recovery utility. Hopefully, you won't need to use it, but in the event of disaster, it's nice to know that help is a single key-press away.

On the left-hand side, you'll find two further USB ports, one of which is USB 2 and doubles up as a power connector, while the other supports USB 3. There's also a micro-HDMI port and a 4-in-1 card reader, supporting the SD, SDHC, SDXC and MMC standards.

Wireless connectivity, finally, covers all the expected bases, including dual-band 802.11ac Wi-Fi and Bluetooth 4.

Despite my criticisms, I like the Yoga 700. It's fast enough for everyday use, as well as being light

and flexible. I even like its design, particularly the metallic, "burnt" orange of our review sample. I'd be interested to see how it bears up after a year or two of punishment, with the budget price reflected in an all-plastic finish, but this looks like a much more

ABOVE Unlike other Yogas, the 700 weighs a manageable 1.1kg

BELOW The Yoga's "tent" mode is great for watching films



expensive laptop than it really is. One word of caution, though, because the price only includes a 128GB SSD. In my experience, that isn't enough for a laptop that's going to have any serious use. It limits how many "big" programs (think Adobe and Microsoft in particular) you can install, and leaves little space for media-hungry files such as videos and photo dumps. In fact, once you take into account Lenovo's hidden recovery partition, there's only 98GB of usable space to start with anyway.

That doesn't mean you should stay away, but it does mean buyer beware: you're getting a well-designed, light laptop that doubles up as a tablet when you fancy reading or watching rather than doing, but enthusiasts will rub up against frustrations once they start pushing it beyond the basics. **TIM DANTON**

SPECIFICATIONS

Dual-core 900MHz Intel Core m3-6Y30 • 8GB RAM • 128GB SSD • 11.6in 1,920 x 1,080 IPS display • SD/SDHC/SDXC slot • 2 x USB 2 (one supports DC-in) • USB 3 • 720p webcam • 802.11ac Wi-Fi (2x2) • Bluetooth 4 • 40Wh Li-ion battery • Windows 10 Home • 1yr RTB warranty • 290 x 16 x 197mm (WDH) • 1.1kg



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Asus Zen AiO Z240ICGT

A top-end spec for an admittedly top-end price: the Zen AiO is a genuine iMac alternative

SCORE ★★★★★

PRICE £1,250 (£1,500 inc VAT) from johnlewis.com

Many all-in-one PCs aim for premium status, but few hold a candle to Apple's iMac. Asus could actually compete thanks to the Zen AiO, though – this all-in-one has styling to match the spec.

The Zen AiO's gold-tinted, brushed-metal chassis and sharp, machined corners make it look and feel every bit the premium computer. However, form appears to have beaten function, with Asus mimicking Apple's approach to port placement: four USB 3 ports, two HDMI ports, an SD card reader and 3.5mm audio jack are all rear-and-centre, making them comically difficult to reach. Unlike Apple iMacs, which are easy to rotate despite their size, the Zen AiO's flipper-like stand is harder to spin around. You may soon find yourself ordering a USB hub.

All that is forgotten, though, once you look at the 23.8in, 3,840 × 2,160 screen. The Zen AiO is aimed at professionals as well as home users, so Asus has paid real attention to colour performance. With 99.9% coverage of the sRGB colour gamut and a Delta E of just 3.7, it's a seriously impressive panel. It's bright too, with a peak of 303cd/m². Our only gripe is the slightly high 0.33cd/m² black level. That's acceptable on a cheaper PC, not one looking to entice video producers and photographers: it's difficult to differentiate blacks with dark shades of grey, compromising detail.

Still, film lovers will enjoy the action as the speakers pack real punch: music, explosions and speech all sounded surprisingly full of depth. Fan noise is kept to a minimum, too, even when at full speed.

That's partially because the quad-core, 2.8GHz Core i7-6700T processor is a slightly underclocked

version of Intel's desktop i7-6700, but it can still hit a maximum boost speed of 3.6GHz. Paired with 16GB of DDR4 RAM, the Zen AiO managed an overall benchmark score of 86. This included a rather low score of 70 in the image rendering benchmark. We suspect some of this lethargy is down to the 5,400rpm 1TB hard disk.

The 4GB Nvidia GeForce GTX 960M graphics card is a mobile rather than desktop component, but it's still a decent performer. It achieved 46.2fps in the *Dirt: Showdown* benchmark at Full HD, and managed 18fps in the extra challenging *Metro: Last Light Redux* benchmark. It's a capable gaming PC as long as you stick to 1080p and High detail settings.

Certain games can even take advantage of the Intel RealSense camera, above the display, which allows for advanced motion controls.

ABOVE The Zen AiO's gold-tinted, brushed-metal chassis is one of the nicest we've seen

"Kudos to Asus: the Zen AiO is a premium all-in-one PC with plenty of power and a terrific screen... but it's not perfect"

BELOW There's no shortage of ports, but their placement is questionable

More practically, it lets you exploit Windows 10's Hello, which logs you on instantly by recognising your face.

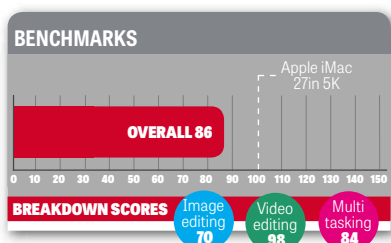
Asus shows it still has something to learn from Apple by its choice of bundled mouse and keyboard – they're wireless but made from plastic. The keyboard has a decent

amount of travel and isn't overly spongy, but we'd expect more than a basic two-button-and-scroll-wheel mouse with a £1,500 PC.

Kudos to Asus: the Zen AiO is a premium all-in-one PC with plenty of power and a terrific screen. It can even play a few games. But it's not perfect. We have reservations about the sluggish hard disk, which harms its credibility when working with photos and high-res video. If you're aiming this high, you should get everything right – especially when £99 more will buy a 5K iMac with a 27in screen. **MICHAEL PASSINGHAM**

SPECIFICATIONS

Quad-core 2.8GHz Intel Core i7-6700T processor • 16GB RAM • 1TB 5,400rpm hard disk • 23.8in 3,840 x 2,160 IPS touchscreen • Nvidia GeForce GTX 960M graphics • 2MP Intel RealSense camera • 802.11ac Wi-Fi • Bluetooth 4 • SD slot • USB 3.1 • 4 x USB 3 • USB 2 • 2 x HDMI • Windows 10 Home (64-bit) • 1yr RTB warranty • 585 x 190 x 434mm (WDH) • 7.3kg



Asus Chromebit CS10

It's cheap, but can the Chromebit really serve as a fully functioning desktop PC? You bet it can

SCORE ★★★★★

PRICE £75 (£90 inc VAT) from amazon.co.uk

The Asus Chromebit is a new twist on the stick PC. Intel started the trend with the Compute Stick, and plenty of other manufacturers have joined in since, including Hannspree with its Micro PC – a device we really wanted to love, but couldn't quite recommend (pcpro.link/258hannspree). The Asus Chromebit is different. Unlike the Intel and Hannspree devices, it runs Google's lightweight Chrome OS, which seems to make more sense for the form factor.

So, who is this tiny machine for? It is here we strike our first problem. Even Asus doesn't seem to know, mentioning in the same marketing breath families, businesses, schools and buyers in the market for digital signage. Can it really have something for all of these target markets? And is it any different from the Windows-based sticks?

Physically, the answer to the latter question is no – the same limitations that hold back the Windows-powered sticks are present on the Chromebit. There's only one full-sized USB port and a power connector, and that's your lot. Bluetooth 4 is included, allowing you to connect wireless keyboards and mice.

Alternatively, you can use a conventional wireless keyboard and

mouse set, one that comes with a single wireless adapter, but that will eliminate your ability to connect any other USB peripherals to the Chromebit. It all starts to get a bit unwieldy when you add on a USB hub, rather defeating the portability the Chromebit offers. If you're going to need a USB hub, you might as well buy a mini PC instead.

The CS10 is powered by an ARM-based Rockchip RK3288C processor. This is a quad-core chip that runs at up to 1.8GHz, and is paired with 2GB of 1,066MHz LPDDR3 RAM. It isn't a powerhouse by any stretch of the imagination, but as is so often the case with Chrome OS, things aren't as bad as they could be. Google Docs runs smoothly and I never had any issues when working on multiple documents and switching windows.

However, things were a little slower working with larger Google Sheets spreadsheets, and copying and pasting between them took longer than I'd have liked. As a demanding user, I found myself feeling slightly hamstrung most of the time, but I wasn't overly frustrated. I got everything I needed to do done, just a little slower than usual.

Multimedia- and ad-heavy web pages tended to lag and stutter when I scrolled down them, and loading times weren't exactly lightning-

quick. But it's all acceptable for a £90 PC. I was particularly impressed by the performance of Polarr, the free online photo-editing program. Manipulating 20-megapixel images, the sort of resolution you can expect to find from high-end smartphones, was quick and easy, thanks to the 600MHz ARM Mali-T760 graphics chip. I also attempted to play a selection



ABOVE The Asus Chromebit has one full-sized USB port and a power adapter

"You can work on offline documents using a Chrome extension if you take the Chromebit to somewhere with dodgy internet"

LEFT Google's lightweight Chrome OS makes sense for the form factor

of web-based Flash games, but these websites' penchant for huge ads meant that most of the games were unplayably laggy.

The GPU handled 1080p video without a hitch, making it a viable media streamer if you want to plug it into the back of your TV. If you plug it into a device capable of a resolution greater than 1,920 x 1,080, however, your desktop will be accordingly stretched: the HDMI connector on the Chromebit only supports Full HD resolution.

The Chromebit also comes with only 16GB of onboard storage, and there's no microSD slot to expand this further. With Chrome OS installed, there's just under 10GB of free space to play with. That's not much, but since Chrome OS is heavily focused on using the cloud for data storage, pulling stuff down to your device as and when you need it shouldn't be a huge problem.

It's a completely different way of thinking compared to the traditional store-everything-locally-and-sometimes-back-things-up approach that many people are used to. With internet speeds getting faster all the time (in most places) and Google's web-based applications improving, working on files that never really exist on your local device is starting to feel like the norm. You can also work on documents offline using a Chrome extension if you find yourself taking the Chromebit somewhere with a dodgy or non-functional internet connection.

On the face of it, the Asus Chromebit is a good-value device. A relatively capable PC for £90 is a bargain whichever way you look at it, although it's not as cheap as I would have expected for such a low-powered device unencumbered with an expensive Windows licence. The Chromebit makes sense if you're a light user and already have a monitor

with an HDMI port. Furthermore, you'll also have to splash out on either a wireless keyboard and mouse or a USB hub to connect your current wired peripherals. If this sounds like you, the

Chromebit is perfect. However, for everyone else, it's too limited both in power and flexibility to replace a genuine PC. **MICHAEL PASSINGHAM**

SPECIFICATIONS

Quad-core Rockchip RK3288C processor
 • quad-core ARM Mali-T764 GPU • 2GB RAM • 16GB storage • 100GB of Google Drive storage (free for 2yrs) • 802.11ac Wi-Fi • Bluetooth 4 • HDMI out • 1x USB 2 • 18W power adapter • Chrome OS • 123 x 31 x 17mm (WDH) • 75g





Asus ZenWatch 2

No more and no less than a basic, elegant and affordable Android Wear smartwatch

SCORE ★★★★★

PRICE £125 (£150 inc VAT) from
currys.co.uk

The Asus ZenWatch 2 is among an increasing number of Android Wear smartwatches struggling to find a niche in the bold new world of wearable tech. It's a second-generation smartwatch, but as with many other newer devices, there isn't much on paper to entice. Indeed, take a look at the specifications (and the appearance of the watch for that matter) and you'll see hardly any difference between it and the first Asus ZenWatch.

To start with, it has the same processor as its predecessor: a 1.2GHz Qualcomm Snapdragon 400. It has the same 512MB of RAM and 4GB of storage, which means, like most Android Wear watches, it sometimes feels sluggish. It also has an identical 1.63in OLED display with precisely the same, slightly grainy-looking, 320 x 320 resolution.

Asus hasn't added GPS or a continuous heart-rate monitor, which will disappoint anyone looking for a device for tracking fitness. And it hasn't dramatically altered the look of the watch either, retaining the elegant design and square watch face I so liked in the original, but also keeping the thick, rather ugly, bezel surrounding the screen.

But it isn't entirely identical. That would be silly. In fact, Asus has made a number of subtle, yet significant alterations. The ZenWatch now has a button on the side, used for enabling and disabling Cinema mode (for switching the screen on and off so notifications don't disturb you in the dark), entering Sunlight mode (which temporarily boosts screen brightness) or launching into the Apps menu (hold it down). This is a genuinely useful addition, and I found myself using the button all the time, especially for activating Cinema mode.

There are also a number of new straps and finishes: the ZenWatch 2's stainless steel case comes in gunmetal grey, silver and rose gold, while the original was only available in one finish. There are also nine different



straps to choose from. The ZenWatch 2 is more dust- and water-resistant, too. Thanks to a change in chassis manufacturer and the addition of interior rubber sealing, the new watch is rated at IP67 instead of IP55 as the original was. I still wouldn't take it swimming, though.

But the big news is that the watch has been improved in the place it desperately needed it: battery life. The first ZenWatch barely lasted a day in general use. The new one's larger battery allows it to extend that stamina well into day two. In general use, I found I was able to get through a couple of days before needing to connect it to its proprietary magnetic USB charger cable. The watch lasts even longer than two days if you disable ambient mode, meaning the screen only turns on when you tap the watch face or raise your wrist.

This is mainly thanks to a larger 400mAh battery (31mAh larger than the old one), but also to a new sensor arrangement. The ZenWatch 2 has a six-axis sensor, controlled via a "sensor hub", whereas the old watch had a nine-axis sensor and "bio sensor", which it used to monitor your heart rate. The sensor hub, like Apple's M-series co-processors, is a separate, low-power chip that's designed specifically to monitor the accelerometer, allowing the watch to track your

ABOVE Asus hasn't dramatically altered the design, retaining the square watch face of the original

"The ZenWatch 2 doesn't pretend to be anything but a low-cost, stylish Android Wear smartwatch and at that job it succeeds well"

BELOW A change of chassis means that the ZenWatch 2 is now more dust- and water-resistant



steps and sleep without consuming too much battery.

The other major change with the ZenWatch 2 is to the companion app used to manage it. Clearly unsatisfied with the homogenous me-too nature of Android Wear, Asus uses its ZenWatch Manager app (downloadable from Google Play) as an alternative to add supplementary features.

It certainly looks different, being both brighter and more colourful than the standard Android Wear app. But is it more useful? Not really. The only significant extra feature it adds is the facility to customise and design your own watch faces. You can add touch-based widgets to your face here, change the background, the ticks around the edges and even the watch hands.

The results, however, are hit and miss and this is principally because the majority of the faces supplied to use as your base watch face are ugly. Plus, the level of customisation isn't a patch on third-party tools such as WatchMaker and Facer.

It's a similar story with the rest of Asus' preloaded apps. These cover music playback, weather updates, fitness and sleep tracking and each has a corresponding app that must also be installed on your smartphone. None of them, however, do

anything third-party apps couldn't do better, and simply serve to confuse new users.

Still, the Asus ZenWatch 2 doesn't pretend to be anything but a low-cost, stylish Android Wear smartwatch, and at that job it succeeds well. It looks stylish, and the improvements to battery life are a major bonus.

For many people, that will be recommendation enough. However, with older, better appointed Android Wear watches coming down in price all the time (the LG Watch Urbane, for instance, is now around £170), it's worth checking out those before you take the plunge. **JONATHAN BRAY**

SPECIFICATIONS

Quad-core 1.2GHz Qualcomm Snapdragon 400 processor • 512MB RAM • 4GB storage • 1.67in 320 x 320 OLED display • Bluetooth 4.1 • 802.11g Wi-Fi • 400mAh battery • accelerometer • Android Wear OS • 1yr RTB warranty • 50 x 10.9 x 41mm (WDH)

Ricoh Theta S

A great way to take 360-degree photos and videos but sharing options need to be improved

SCORE ★★★★★

PRICE £249 (£299 inc VAT) from jessops.com

When the first Ricoh Theta appeared back in 2013, it broke the rules of photography – and I find the concept as appealing now as I did then. This is photography unhindered by all the usual conventions, photography without the frame, and it's amazing how different that feels. Since launch, it's been updated with the Theta m15 version, which added much-needed video support, while the Theta S boosts the quality of stills and video.

The core appeal of the Theta remains the same. Hold it up, press the big button and move on. So much simpler than fiddling with exposures and ordering friends into a space that fits the frame.

While you may not want the faff, you will still want good-looking photos and the Theta S is far better equipped to capture these than the original. As before, the dual sensors, one on each side, use fisheye lenses to capture a 180-degree image, with the two images being stitched together to form the final 360-degree picture.

The optics have been given an upgrade, with the 3.2-megapixel sensor of the first Theta being replaced by a pair of 1/2.3in CMOS 12-megapixel sensors behind a marginally brighter f2 lens. With the resolution stretched across such a huge angle of view, it still isn't pin-sharp, but what it lacks in quality it makes up for in engagement.

Certainly, the quality is more than sufficient to get a feel for your surroundings. The new sensors and lenses mean you can take decent-looking photos anywhere you'd expect a modern phone to cope, except perhaps in low light. There's no flash here to help out.

There's no screen on the device, but it's easy to link it via Wi-Fi to your phone (iOS or Android) and transfer photos. These can then be viewed on your phone, spun around and zoomed using the usual gestures. From here, you can share your pics to either Facebook or Twitter. You get a still sample from the full 360-degree image, and clicking on it takes you through to the Theta website where you can see the whole thing. You can also upload geolocated photos to Google Maps.

The app allows you to take remote control of the Theta S, primarily so you can take pictures or record video without having your arm and face front-and-centre. From here you can tweak the exposure with shutter priority, ISO priority and manual modes (the aperture is fixed) and set the white balance. You can also set up timelapse photos, deciding on the interval between frames and the total number of shots.

This is the first time I've seen a Theta with video capability and it's mind-blowing. Place the Theta somewhere with a good all-round view of the proceedings – be that dinner with friends, opening the presents at Christmas or on a building site – and set it running. The resulting footage is hugely engaging and my friends loved spotting themselves in the crowd.

You can record videos up to 25 minutes long, which fills half of the available 8GB of internal storage; note the lack of any SD slot for adding more. If you're only shooting photos, there's space for around 1,600 full-resolution JPEGs (5,376 x 2,688). Not that the battery will last long enough to fill it, with Ricoh quoting a life of 260 images per charge.

So, you've impressed friends and family with your 360-degree footage: how do you go about viewing videos onto the internet? The Theta S supports live streaming (again,



ABOVE The Theta S has a pair of 1/2.3in CMOS 12-megapixel sensors tucked behind a f2 lens

BELOW The Theta S' portability and ease of use make it perfect for regular travellers

there's a 25-minute limit), but the logical choice is YouTube now that it's added support for 360-degree video. The Theta S is compatible with the online service, but only after some fiddling. For starters, ignore the tool YouTube provides – it doesn't work. 360-degree video is begging for a standard way of doing things, especially with VR on the march.

You can't currently upload 360-degree videos directly to YouTube from your phone, either. Instead, you'll have to download and install Ricoh's own tool to add the necessary metadata to the video file first. It doesn't take long, but it does add an extra, annoying step to the process.

Videos look pretty good on Theta's own website, but they seriously drop in quality when uploaded to YouTube. This is surprising given that the site is happy to host 4K and 60fps content and the file sizes aren't huge. The advantage: once it's on YouTube, you can view the video using Google Cardboard or any other VR headset.

If you have a good reason to own a 360-degree video and stills camera, the Ricoh Theta

S is a must-have. Estate agents, location scouts, VR enthusiasts and anyone who puts on live events will love it, and it will appeal to regular travellers looking to capture their trips in a new way. It's incredibly easy to use, too.

The issue with video quality on YouTube is hopefully something Google will fix in the near future, and I can't see why Ricoh can't include the YouTube metadata in every video via a firmware update, so you could then upload directly to the site from your phone. I'd also like to see support for 360-degree content in services such as Facebook, although that can't be blamed on Ricoh.

With its modern camera sensor, the new Theta S is the 360-degree camera to buy. It's simply a matter of thinking up ways to make the most of its unique capabilities. With VR booming, that shouldn't be too hard – it just needs to be better integrated with Google's vision for 360-degree video before it can be recommended.

SETH BARTON

SPECIFICATIONS

2 x 1/2.3in 12-megapixel CMOS sensors • 8GB internal storage • ISO 100 to 1600 • 1/6,400 to 60secs shutter speed • Full HD 30fps video • micro-USB • micro-HDMI • 1yr RTB warranty • 44 x 23 x 130mm (WDH) • 125g



Microsoft Display Dock

Microsoft's Display Dock is a glimpse into the future of mobile working, but it has a few key limitations

SCORE ★★★★★

PRICE £48 (£58 inc VAT) from dabs.com

A couple of months after the launch of Windows 10 Mobile, we finally got our hands on Microsoft's official Display Dock, the adapter required for the operating system's most exciting feature, Continuum, which promises to turn your smartphone into a portable PC.

At the moment, Continuum only works on the Microsoft Lumia 950 and Lumia 950 XL, since it requires a USB Type-C connection to connect to the Display Dock. As a result, the Display Dock won't be any use if you have an older Lumia phone, but it's likely that future Lumia handsets will have the feature.

Once you've connected the 950 or 950 XL to the Display Dock, you can plug it into an external monitor via its HDMI or DisplayPort output, and connect a keyboard and mouse to two of its three USB 2 ports to run a full PC-like desktop setup.

The Dock uses the hardware inside the smartphone while Continuum adapts the layout, allowing mobile apps such as Outlook, Office, Edge and Maps to run full-screen – at resolutions of up to 1,920 x 1,080.

It's a flexible setup, too. Although it's disappointing that none of the USB ports run at USB 3 speed, one is at least a powered USB port, promising fast charge rates of third-party devices such as tablets and battery packs.

And you don't have to use the USB ports at all if you don't want the clutter of wires. You can either hook up a Bluetooth keyboard and mouse to the phone, or just plug in a keyboard and use the screen on the phone as a touchpad. I'd recommend using a mouse where possible, though, as the lack of tactile feedback on the screen meant I wasn't always sure if a tap had been detected.

Despite its small dimensions (64 x 64 x 26mm), the Display Dock weighs almost a quarter of a kilogram (230g). This, combined with a grippy, rubber base, means you shouldn't worry about it sliding around on your desk with every mouse movement.

The physical design is fine, but in use I found even the Lumia 950 XL's

octa-core 2GHz Qualcomm Snapdragon 810 chip and 3GB of RAM weren't fast enough to run Windows 10 Mobile completely lag-free on the big screen.

Navigating around the desktop was fine, but trying to switch between multiple pages in the Edge browser quickly became irritating, often taking a second to load and switch tabs. Scrolling down pages was jerky at times, particularly if there were videos present, and browsing, in general, was very sluggish compared to your average laptop or PC.

Testing with the Peacekeeper benchmark on the Lumia 950 revealed the reason why: Edge on Continuum runs significantly slower than Edge on the phone itself, with a score of 480 on the former and 750 on the latter.

Another of Continuum's caveats is that it only works with Universal apps so there may be several you've downloaded on your phone that you can't use through the Display Dock. That means no Netflix, Skype, Spotify, Twitter or Xbox, at least until their respective developers make them truly Universal. Admittedly, a lack of entertainment apps is one of a problem for office workers, and services such as Netflix can be accessed through the Edge browser, but considering the Windows Store

already has fairly limited app support, this only narrows your selection further.

Thankfully, key apps such as Word, Excel, OneNote, Outlook and OneDrive are supported, and it's with these that Continuum shines. Unlike Edge, we had no performance issues while typing Word documents or working with Excel spreadsheets. In many respects, it was just like working on a laptop.

You can also use the File Explorer app to open Full HD videos, pictures, documents, downloads and music files on your phone's internal storage or any files you have stored on a USB stick. Video playback works a treat, too: I was able to play the Full HD version of the film *Tears of Steel* without any stutter or lag whatsoever.

Web browsing issues aside, Microsoft's

Display Dock could potentially transform mobile office working. There's a fair amount of infrastructure that must be put in place before we get to the stage of simply plugging in our phones and getting down to business, but provided your chosen workplace has the correct monitor, cables and accessories, Continuum has potential.

The big problem with the Display Dock, however, is that currently you have to own a Microsoft Lumia 950 or 950 XL to use it, and neither of these is a phone we'd list among our favourites.

Still, if Continuum appeals, and you're prepared to spend another £60, there's no other flagship or smartphone OS that does anything remotely as clever. **KATHARINE BYRNE**

SPECIFICATIONS

Display connectors: DisplayPort, HDMI
 • system connector: USB Type-C • 3x USB 2 (1x charging port) • 64 x 64 x 26mm (WDH) • 230g • power supply and USB Type-C cable provided



ABOVE The Display Dock turns Windows smartphones into pseudo-desktop PCs

"If Continuum appeals, and you're prepared to spend another £60, there's no other flagship or smartphone OS that does anything as clever"



ABOVE The Display Dock has three USB ports and two display outputs

BELOW The Display Dock's grippy, rubber base keeps it steady



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Huawei Mate 8

A fine smartphone with an enormous screen and great battery life. Shame about the camera and the software

SCORE ★★★★★

PRICE SIM-free, £358 (£429 inc VAT)
from vmall.eu

Can a 6in smartphone such as the Huawei Mate 8 ever be practical? That's the first question that leapt into my mind when I pulled the Chinese phone manufacturer's latest handset from its slim, black box. I didn't think such large phones were practical when Google released the Nexus 6 a little more than a year ago; and now, after a week of using the Mate 8 as my main handset, I still don't think I'd want to own a phone this big.

That isn't to criticise Huawei's design engineers in any way. They've done a stunning job on the design of this phone, keeping the dimensions as small as possible. Given the screen size, I can't imagine it being any smaller. But therein lies the rub. Whichever way you cut it, six inches is six inches.

Still, if you're determined to own a phone with as large a screen as possible, the Mate 8 is one of nicest models I've come across. This is mainly due to the incredibly narrow bezels surrounding that enormous screen. To the left and right, there's a distance of roughly 3mm from the edge of the phone until the screen begins. The phone's "forehead" and "chin" measure 6mm and 9mm respectively. The end result is that the Mate 8's front is almost all screen; the way it should be.

That's an impressive feat of design engineering, and combined with the 7.9mm slenderness of the phone, it makes the Mate 8 feel much smaller than it actually is.

It's also a handsome device. The body of the phone comes in a silver and white combo, as pictured here, or gunmetal-grey plus black – and both versions look great. The edges are brushed and have chamfered corners to fool the eye into thinking that they're even thinner than they are. The detailing, from the twin speaker grilles to the textured power button, is impeccably well done. Even the subtle Huawei logo on the bottom of the rear doesn't detract from the overall look and feel of the device.



As I've come to expect from top-end Huawei handsets, it's packed with features as well. There's a circular fingerprint reader in the centre on the rear, just like on the Nexus 6P (also made by Huawei); the screen is topped with premium Gorilla Glass 4; and the SIM card tray has space for either a microSD card or a second SIM card, depending on your preference. With 32GB of storage in this model, I'd be tempted to use the slot for the former.

The controls and ports are sensibly placed: headphone socket on top, micro-USB socket on the bottom and the buttons on the top-right edge. No acts of contortion are necessary to adjust the volume up and down.

Interestingly, although there are two speaker grilles on the bottom edge of the Mate 8, the phone only has one speaker. This isn't a problem, though: you wouldn't get much of a stereo image even if there were two.

■ A phone of extremes

As with so many Huawei devices, the Mate 8 is a phone of extremes: as soon as you it switch on, you'll see why. It runs Huawei's proprietary Android skin – EMUI 4 – so although there's Android 6 underneath, you won't see much evidence of its elegant lines and thoughtful features.

The key point of difference between Huawei's version and stock Android is that there's no App Drawer. As with iOS, all your apps are shown on the desktop, which adds unnecessary clutter.

Huawei hasn't stopped there,

either. It's also fiddled with the appearance of icons, awkwardly squeezing them into a round-cornered box so they all have exactly the same shape. This may not sound offensive, but many Android apps have circular or irregularly shaped icons, and these look absolutely horrible.

Elsewhere, the pull-down notifications menu is inelegantly presented on two tabs, with the brightness slider and shortcut toggles rather irritatingly on the second one. And EMUI is stuffed with preloaded apps that you may not want.

There are certain features I do like. The clock app is very neat indeed, with an audible tick on the countdown clock and a smart Newton's Cradle interface. The power-management tools – which can be set to notify you whenever they spot an app using too much power in the background – are undeniably useful. However, surely these could be implemented without the fussy, overbearing redesign. Android 6 Marshmallow looks great on its own – please leave it alone, Huawei.

ABOVE It's hard to see how Huawei could have made a phone with a 6in screen any smaller or sleeker

■ Performance

All of this is a shame because the rest of the Mate 8 is great, including the performance of the CPU and graphics. As usual for a Huawei phone, the processor is a HiSilicon unit, but this isn't a CPU I've come across before. It's the very latest 16nm Kirin 950 – a step up from the Kirin 935 in the Huawei Mate S Press Touch – and it's backed by 3GB of RAM.

Normally, this would signal the start of a moan about sluggish performance and a general lack of responsiveness, but this time it's

different. In fact, in terms of pure CPU grunt, the Kirin 950 is a cracker. It flew through Geekbench 3, beating the Nexus 6P by almost 50% in both the single-core and multi-core tests.

Perhaps this shouldn't be a surprise. The chip is an octa-core unit made up of a pair of quad-core ARM-design CPUs. One is a 2.3GHz Cortex-A72 CPU, used for intensive tasks; the other is a 1.8GHz Cortex-A53 for low-power jobs, and both do an good job of keeping the phone's UI moving.

"If you're looking for that big-screen phone experience with few of the drawbacks, the Mate 8 should be on your shortlist"

The Mate 8 feels responsive in every way. It restarts and boots in seconds, apps launch at a snap and web pages load, scroll and pan smoothly. It's the level of performance you'd expect from a flagship phone.

Even graphics performance, which has in the past been a weak area for Kirin chips, is pretty good. The Huawei Mate 8 can't match the might of the Apple iPhone 6s, but it's on a par with the Nexus 6P (Qualcomm Snapdragon 810) and it's well ahead of the dismal Mate S and its Kirin 935.

Screen

The Mate 8 has a great screen, too. Let's get one thing out of the way first: the resolution is only 1,920 x 1,080, but this isn't a problem. At no time since I've been using it have I noticed any graininess or pixellation. Despite what the manufacturers would have you believe, Quad HD and 4K displays aren't really necessary, even on a 6in smartphone.

Furthermore, the quality is rather good. It's bright, reaching a maximum of 505cd/m² at maximum settings. Contrast hit a high of 1,402:1, ensuring black looks inky and colours really leap out. The screen covers 99.3% of the sRGB colour space, which is outstanding. The only weakness is that colour accuracy is out of whack, particularly in green and red tones, meaning graphics can look strange.

But this is easy to forgive in light of the Huawei Mate 8's battery life. In day-to-day use, I could eke one-and-a-half day's use from the Huawei Mate 8's huge 4,000mAh battery. If you use the phone sparingly, you should be able to squeeze out two days' full use.

Oddly, its performance wasn't quite so strong in our video-rundown battery test, but its runtime of 11hrs 48mins is on a par with the Nexus 6P. All told, battery life is considerably better than average.

BELOW It's a 16-megapixel camera, but don't be fooled by the specs



LEFT Huawei crams a large, 4,000mAh battery into the Mate 8's 7.9mm-thick body

It's a shame, then, we can't say the same for the cameras. There's nothing missing in terms of their raw capability. On the rear, you get a 16-megapixel shooter with an f/2 aperture, optical image stabilisation, phase-detect autofocus and a dual-LED flash. The front camera is an almost-as-impressive eight megapixels.

However, despite the specifications, the resulting photographs and videos are mediocre, with still images looking soft and lacking in detail compared with the best cameras.

That means, therefore, this is one area where the Nexus 6P stands head and shoulders above the Huawei Mate 8. The Google-branded phone produces shots that are crammed with far more detail, in both good light and poor, and that have both richer colours and generally better all-around exposure.

Conclusion

The Huawei Mate 8 remains a very likable handset. It's a little too large for my pockets, but I love the design and it's been a real pleasure to use. The sluggish performance of past Huawei flagships has been banished thanks to the Kirin 950 processor, and battery life isn't half bad either.

Couple that with a tempting SIM-free price of £429 inc VAT, and you have a phone that holds a good deal of appeal. If you're looking for that big-screen phone experience with few of the drawbacks, it should be on your shortlist.

There are, however, a couple of critical things that undermine its bid for greatness. First, the proprietary EMUI software, which, given the choice, I'd replace in an instant. The second is the slightly iffy camera, which produces soft images, despite impressive specifications.

In short, unless you're entirely wedded to the idea of carrying around a 6in phone, you can do better than this. It may not have a 6in screen, but I'd recommend sacrificing 0.3in and opting for the 5.7in Google Nexus 6P instead. **JONATHAN BRAY**

SPECIFICATIONS

Octa-core 2.3GHz/1.8GHz
HiSilicon Kirin 950 CPU • 3GB RAM • 32GB storage • 6in 1,920 x 1,080 IPS display • dual-SIM/microSD slot • 16MP/8MP rear/front cameras • 802.11ac Wi-Fi • 4G • Bluetooth 4.2 • 4,000mAh battery • Android 6 • 1yr RTB warranty • 80 x 7.9 x 157mm (WDH) • 185g

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Bluetooth speakers



Beats Pill+

SCORE ★★★★★

PRICE £158 (£189 inc VAT) from beatsbydre.com

Sleek, compact and light, the Beats Pill+ is a deceptive little speaker. It's just that little bit in love with itself, with a backlit "b" on the top in stark contrast to its black surround, but it packs plenty into that tiny form.

Audio quality sits in the middle of the pack, but that isn't a damning statement when the standard is so high: on a slow jazz track, for instance, the low echo of a bass drum is perfectly clear and all the instruments are easy to make out, so it can deliver subtlety. As soon as tracks get more tempestuous, though, the audio becomes a tad muddled.

Moreover, note the lack of support for the aptX codec, but this isn't surprising because iPhones and iPads don't support it – Beats is an Apple brand, after all. Then again, this speaker puts style and convenience at the top of its agenda and, with a 12-hour battery life and simple interface, it's exactly what you'd expect from Apple. Sadly, it also has a price to match.

SPECIFICATIONS 12hrs battery life • Bluetooth 4 • 210 x 69 x 63mm (WDH) • 745g



JBL Xtreme

SCORE ★★★★★

PRICE £149 (£179 inc VAT) from johnlewis.com

The biggest and boldest speaker on test here, the JBL Xtreme is our top party choice by a mile. It packs bags of bass that rebounds around the room – and your entire house – and you can connect up to three phones simultaneously if you want to vary the DJ. The speaker handles classical music and vocals well, but lacks the clarity of the KEF Muo, in part due to that non-too-subtle bass.

Unlike the KEF, though, the JBL Xtreme is rugged enough to go anywhere: it's "splashproof" rather than waterproof, but you could take it out on a drizzly day without fear. JBL even provides a strap that clips onto either side like a satchel, which is a good thing when you consider its 2.1kg weight. The other bonus: with two USB ports, you can use it as a portable charger thanks to its enormous 10,000mAh battery.

SPECIFICATIONS 12hrs battery life • Bluetooth 4 • 2 x USB • 283 x 122 x 126mm (WDH) • 2.1kg



KEF Muo Wireless Speaker

SCORE ★★★★★

PRICE £250 (£300 inc VAT) from amazon.co.uk

If the KEF Muo was to walk into a roomful of Bluetooth speakers, a respectful hush would descend: it's royalty when it comes to audio quality. Put on a piece of orchestral music and it feels like you're there; listen to a radio play and you can hear every detail; play a thumping drum'n'bass track... well, that's where you may be disappointed, because at this size it inevitably lacks punch.

There's no lack of style, though, with the "storm" grey of our sample looking suitably regal. Naturally, it supports aptX

Bluetooth, and can be paired with another Muo to provide stereo output.

Cleverly, it can be used either vertically or horizontally: an internal sensor determines its orientation and changes the output. Is it worth the money? If you're an audiophile, undoubtedly. It's a stunning speaker with incredible sound quality.

SPECIFICATIONS 12hrs battery life • Bluetooth 4 • NFC • 210 x 60 x 80mm (WDH) • 800g

"Put on orchestral music and it feels like you're there; listen to a radio play and you can hear every detail"

shootout

The latest Bluetooth speakers deliver crisp sound quality, look great and pack bags of features. We put six through their paces



Libratone Zipp Mini

SCORE ★★★★★

PRICE £149 (£179 inc VAT) from libratone.com

This is a crazy versatile speaker, as we've come to expect from those Scandinavian iconoclasts at Libratone. You can think of it as a rival to Sonos, with multi-room audio support if you buy more than one (and you will be tempted).

Connect it to your wireless network and it becomes an internet streaming radio: using the not terribly intuitive app, you can select up to five favourites and then select them directly using the touch-sensitive button on the top of the speaker. Or you can link it directly to your Spotify Premium account. Cleverly, there are very few places it can't go. The strap makes it easy to carry with you or hang up on a hook in the bathroom.

This is a real all-rounder, too, with support for aptX Bluetooth, Spotify Connect and AirPlay. While it can't match the KEF for clarity or punch, it's still a fine, warm speaker. Its particular talent is down to the circular design, which means music plays evenly in all directions. No matter where you put this speaker, it will sound great.

SPECIFICATIONS 10hrs battery life • Bluetooth 4 • AirPlay • USB • 100 x 100 x 224mm (WDH) • 1.1kg



Phillips Izzy BM5

SCORE ★★★★★

PRICE £83 (£99 inc VAT) from ao.com

Designed to be inexpensive multiroom speakers with wide appeal, Philips' Izzy range focuses on simplicity. You don't even need to connect it to your wireless network because it creates its own: just hit the "Group" button on each speaker you want to synchronise, and one of the speakers takes the lead as the "Master" speaker.

Your music source communicates over Bluetooth, so always needs to be within 10m of the master speaker. That's a drawback, but it means you can access any streaming service from your device; rivals such as Sonos need to add support. Also, note the BM5 isn't portable: it must be plugged in.

Audio-wise, the BM5 packs punch but struggles with treble detail and doesn't have the presence of rivals. It's fine for easy listening in the kitchen, though, and we can't dispute that the price is right.

SPECIFICATIONS No battery • Bluetooth 4 • 165 x 118 x 165mm (WDH) • 1.1kg



UE Boom 2

SCORE ★★★★★

PRICE £83 (£100 inc VAT) from johnlewis.com

Roughly the size of a pencil case, the UE Boom 2 is designed to be your carry-anywhere speaker to survive all weathers. You can shower with it, leave it in the rain, even drop it into a bucket of water. Its tough-rubber finish also means you can chuck it into a rucksack or a suitcase and not worry about it. Battery life is yet another strength – the longest we've come across, at a quoted 15 hours.

Its weakness is sound quality, with a lack of warmth evident in our testing. Pianos, for instance,

emerged a little harshly, and supposedly funky tracks such as "Get Lucky" felt like they'd been smartened up and slipped into starched shirts.

It's a speaker for those people who need a rugged companion rather than the last word in sound quality, but a recent price cut makes it undeniably attractive.

SPECIFICATIONS 15hrs battery life • Bluetooth 4 • NFC • 67 x 67 x 180mm (WDH) • 548g

"You can shower with it, leave it in the rain, even immerse it in a metre of water for half an hour"

Pinnacle Studio 19 Ultimate

Lots of strong features, but the new ones are relatively modest and the controls could be more responsive

SCORE ★★★★★

PRICE £83 (£100 inc VAT) from pinnaclesys.com

Pinnacle Studio may not have the name recognition of Adobe or Sony, but it has enough high-quality features to make it a worthy opponent to Premiere Elements and Movie Studio Platinum.

New to this version is multi-camera editing, with a streamlined interface to cut between footage shot simultaneously with multiple cameras. This might be handy for events such as speeches and first dances at a wedding, where multiple guests capture the action with their cameras and phones. Or cut between multiple camera angles shot during a theatrical performance.

Studio 19 supports up to six simultaneous streams in the Ultimate edition, four in Studio Plus and two in the entry-level version. The manual explains how to use it, but not where to find it – I eventually tracked it down in the right-click menu when browsing assets in the Library.

The various cameras' footage is synchronised automatically by analysing their soundtracks. Each one plays back in a thumbnail-sized window, and cutting between them is a simple matter of clicking on one of the thumbnails. The edited footage appears in a bigger preview window. These edits can be performed live during playback, and can also be adjusted on the timeline either by dragging the start and end points or by right-clicking to select an alternative stream.

Back in the main editor, the Multi-Camera Editor's output is represented by a single object. Double-clicking it unpacks it on the main timeline, whereupon transitions and effects can be added. I particularly like how an effect can be applied to a single cut, one of the underlying video



ABOVE The interface allows you to cut between footage shot simultaneously with multiple cameras

streams or the entire multi-camera object. You can also adjust the timing of cuts here, or switch streams, without losing sync.

Preview performance in the Multi-Camera Editor was pretty bumpy when editing six 1080p AVC streams on our 2.8GHz Core i7-870 PC. It coped better with four streams, although it varied widely depending on which camera's footage was used. Attempting to combine footage from three different cameras caused the software to crash repeatedly. I eventually narrowed down the problem to Panasonic G6 footage, which sent the Multi-Camera Editor into a nosedive, even though the main editor had no problems with it. Footage from the Panasonic GX8 and FZ330 suffered a similar fate.

Studio Ultimate already scored highly for its effects, particularly in the third-party bundles from Red Giant and NewBlue. There's yet another pack this time around, NewBlue Video Essentials IV, with ten creative effects such as Fish Eye, Magnifying Glass and Luma Key, which hides pixels beyond a given brightness threshold.

The other new features are harder

"I like how an effect can be applied to a single cut, one of the underlying video streams or the entire multi-camera object"

BELOW The NewBlue Video Essentials IV pack comes with ten creative effects such as Magnifying Glass

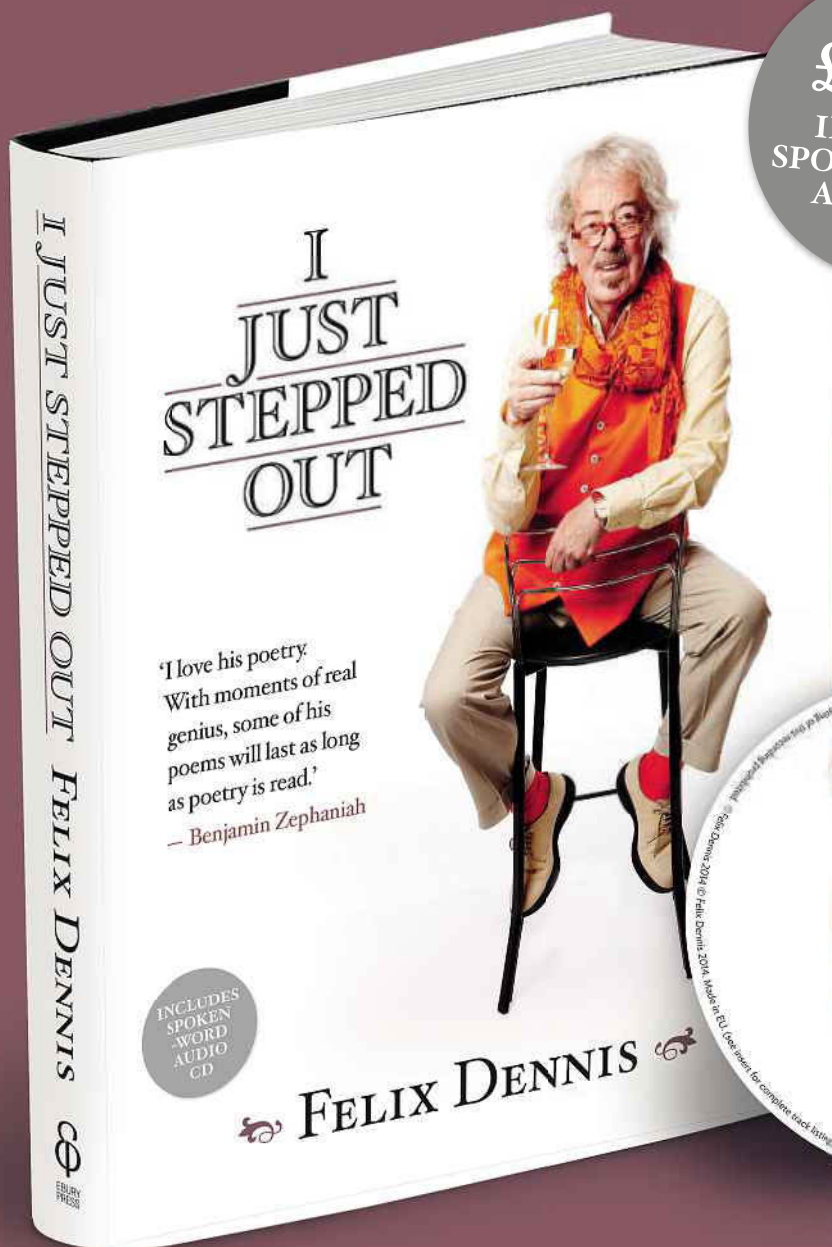


to get excited about. An audio ducking feature makes speech easier to hear by automatically reducing the volume on other tracks when speech is detected. It works well when speech has been recorded clearly with a microphone near the person talking, but most home videos aren't shot like that. The software was unable to distinguish between speech and other sounds in the main soundtrack, and ducked the music volume up and down fairly indiscriminately. Avoid.

There's now explicit support for the XAVC-S format used by recent Sony cameras, with XAVC-S exports at up to 4K. Last time I tested Pinnacle Studio, at version 17, 4K support had just been added, but review performance wasn't up to scratch. This time, it appears to be better, but it wasn't consistent. Footage would sometimes play smoothly, yet at other times drop to around one frame per second. Even more annoying was waiting up to ten seconds for the interface to catch up when making basic timeline edits. Different hardware and footage will give different results, but in my experience Adobe Premiere Elements and Sony Movie Studio Platinum handle 4K editing more efficiently.

Unresponsive controls were often an issue when editing 1080p footage, too. Simple tasks such as dropping media onto the timeline or applying colour correction caused the software to respond in fits and bursts. These delays were seldom significant, but even the slightest delay makes precise adjustments much harder to achieve. Pinnacle Studio comes close to a Recommended award, but this is the reason it falls short. **BEN PITT**

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1 Mobile scanner Xerox DocuMate 3115

Some clever thinking here: when you're on the road and need to scan contracts, receipts, documents, photos and the rest, the Xerox DocuMate 3115 slips in your briefcase (all powered by USB, naturally). And when you're back in the office, slot it into the docking station, below right, complete with a 20-page-per-minute automatic document feeder.

£310 xeroxscanners.com

While the DocuMate 3115 is Xerox's flagship mobile scanner, it's by no means your only choice. Here are two alternatives that may be right for you:

Xerox Travel Scanner 150 £128

- Instant scan to searchable PDFs for easy search and retrieval
- USB-powered – no external power supply needed
- Lightweight (300g) but scans items up to 8.5in wide and 14in long
- Cloud scanning to Google Drive, Evernote, Dropbox and more



Xerox Mobile Scanner £221

- 4GB SD Eye-Fi Card plus built-in Wi-Fi included
- No computer or cables required to scan
- 300 pages per battery charge
- Compatible with many different types of mobile device



xeroxscanners.com

2



Pico projector Asus S1

Let's not pretend you'll get the brightest image from a pico projector, but when you need to share your screen this works a whole lot better than clustering around a laptop. Despite weighing just 340g, it still packs 200 lumens and an HDMI output, and can project a 41in diagonal from 1m away. Plus it lasts three hours from a single charge.

£267 amazon.co.uk

3



Mobile hotspot Goodspeed 4G

We've all been there: you need to connect to the internet but the Wi-Fi won't work. It's especially bad when you're abroad and can't use your phone. There are plenty of options, but we like the Goodspeed 4G because you can buy SIMs for multiple countries and it's so easy to use: connect and go, just like you would with a Wi-Fi hotspot in the home or office.

£17 per month goodspeed.io

4



Secure external hard drive 750GB iStorage IS-DG3

Quick, lightweight external hard drives are perfect if you need to make a backup while on the road (or just want to use it as a mobile jukebox). For extra security, though, consider an encryptable, password-protected model such as the iStorage IS-DG3, complete with a brute-force self-destruct feature.

£201 stuff-uk.net

5



Emergency power pack Techlink Recharge 12000

Forget USB chargers that slip in your pocket: real power junkies need a power pack with huge amounts of juice, and right now that means the Techlink Recharge 12000 (with 12,000mAh of juice). With both USB and Lightning connectors, it has enough capacity to fully charge an iPad Air or four smartphones.

£90 amazon.co.uk

6



Foldable USB plug with double the power Mu Duo

This is one of those blissful devices you can slip into your case, bag or even pocket, then forget about until you need it. Not only does it improve upon conventional USB plug chargers by offering two USB sockets rather than one, it also folds down to around 1cm thick. If you want to charge tablets fast, the Mu Tablet costs £24.

£22 themu.co.uk

7



Tablet keyboard Microsoft Universal Mobile Keyboard

If you want to get some serious work done on your tablet, you need a proper keyboard. Personal preference matters here – *PC Pro* columnist Davey Winder swears by the £19.50 MiniSuit Keyboard Case for his Nexus 7 – but in terms of maximum compatibility, Microsoft's keyboard is our top choice.

£54 amazon.co.uk



Switch online banks now

How does your bank compare with the best for online services, security and apps? We find out if it's time to switch

You can now change banks in seven working days, and after reading this comparison of ten major banks, you may well decide it's time to switch. It's shockingly easy to do. Just apply – online, naturally – and explain you want to switch. Your new bank will do the rest.

To compare the banks, we asked members of our team to review their own for ease of use, features and security. These days, it's not enough to have a great online portal, so we asked everyone to put their bank's app through the fiscal mill. The ultimate goal is for the app to offer almost every service, but as you'll see, many banks fall well short of this dream.

With convenience comes risk, so we dispatched Davey Winder to report back on areas of concern. Plus, our guide to Midata explains how to use this anonymised, year-long record of your transactions to help you find your perfect bank.

CONTRIBUTORS: Jonathan Bray, Barry Collins, Tim Danton, Alan Martin, Tom Morgan, James Morris, Paul Ockenden, Michael Passingham, Nik Rawlinson and Davey Winder

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	LABS WINNER				RECOMMENDED	
	Barclays	First Direct	Halifax	HSBC	Lloyds	
Website	barclays.co.uk	firstdirect.com	halifax-online.co.uk	hsbc.co.uk	lloydsbank.com	
Overall rating	★★★★★	★★★★☆	★★★★☆	★★★★☆	★★★★☆	

Website features

Overdraft application	✓	✓	✓	✓	✓	
Online bill payment	✓	✓	✓	✓	✓	
Money transfers	✓	✓	✓	✓	✓	
Create standing orders	✓	✓	✓	✓	✓	
Manage direct debits	✓	✓	✓	✓	✓	
Change address	✗	✗	✓	✓	✓	
Buy travel money	✗	✓	✓	✓	✓	
Apply for loan	✓	✓	✓	✓	✓	
Apply for savings account	✗	✓	✓	✓	✓	
Midata download	✓	✓	✓	✓	✓	
Other	Free download of Kaspersky Internet Security 2016 (1yr licence)	Free download of Rapport; text alerts	Free download of Rapport; text alerts	Free downloads of McAfee VirusScan Plus (1yr licence) and Rapport	Bill calendars; free download of Rapport; savings goals; spending analysis; spending plans; text alerts	

App features

Platforms	Android; iPhone	Android; BlackBerry; iPhone; Windows Phone	Android; iPad; iPhone; Windows Phone	Android; BlackBerry; iPhone	Android; iPad; iPhone; Windows Phone	
Pay bills	✓	✓	✓	✓	✓	
Pay friends	✓	✓	✓	✓	✓	
Transfer money	✓	✓	✓	✓	✓	
Create standing orders	✓	✗	✗	✗	✓	
Fingerprint reader support	✗	✗	✗	✗	✗	
Other	Branch finder; view balance on smartwatch	✗	ATM/branch finder; cashback offers	Instant access to balance	ATM/branch finders; cashback offers; replace cards and/or PINs; report lost/stolen cards	

Statements

Export to third-party apps	QuickBooks; OFX	Quicken; Money; Excel; Works; Lotus 123	Quicken; Money	Quicken; Money	Quicken; Money	
Export as PDF	✓	✗	✗	✗	✗	
Export as CSV	✓	✓	✓	✓	✓	

Security

Customer ID	✓	✓	✓	✓	✓	
Memorable phrase	✗	✗	✓	✗	✓	
Security question	✗	✓	✗	✓	✗	
Password	✗	✓	✓	✓	✓	
Hardware required?	✗	Secure key and digital secure key	✗	✗	✗	
Other	Card reader or app required to log in	Certain features blocked without secure key or digital secure key	✗	Telephone or app used to authenticate new payments	Telephone or app used to authenticate new payments	



		RECOMMENDED			
	Nationwide	NatWest	RBS	Santander	Smile
	nationwide.co.uk	personal.natwest.com	rbs.co.uk	santander.co.uk	smile.co.uk
	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓
	✗	✓	✓	✓	✓
	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✗
	Free download of Rapport; request cheque books	Free download of Rapport	Free download of Rapport; manage credit cards	Free download of Rapport; report lost/stolen card; request cheque books; request new PIN	Free download of Rapport
	Android; iPhone	Android; BlackBerry; iPhone; Windows Phone	Android; BlackBerry; iPhone; Windows Phone	Android; iPhone	Android; BlackBerry; iPhone
	✓	✓	✓	✗	✓
	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓
	✗	✗	✗	✗	✗
	✗	✓	✓	✗	✗
	Instant access to balance; manage overdraft; view balance on smartwatch	ATM/branch finder; Apple Watch support (balance, transactions, cardless withdrawals); cardless withdrawals; top up phone	Branch finder; cardless withdrawals; top up phone	Apply for credit cards and mortgages; branch finder; report lost/stolen card	Text alerts
	OFX	Quicken; Money	Quicken; Money; Sage Line 50	Quicken; Money	✗
	✗	✓	✓	✓	✓
	✓	✓	✓	✓	✗
	✓	✓	✓	✓	✗
	✓	✗	✓	✗	✗
	✗	✓	✗	✓	✓
	✓ (Passnumber)	✓	✓	✓	✗
	✗	✗	✓	✗	✗
	✗	✗	Card reader to set up new payees	Anti-phishing image and phrase	Account details plus two digits from a PIN required for login



Barclays

An expansive online service – backed up by two powerful apps – that leaves us wanting for little

SCORE ★★★★★

You'll be hard-pushed to find a better-looking site than Barclays'. Navigation is well thought out, making it simple to find the feature you're after. For instance, it's easy to scan balances on all your accounts, and you'll never get lost when managing your transactions. There are separate tabs for personal and business account lists. The latter can get a little unwieldy, though, since Barclays opens a business savings account to accompany every current account – we have six accounts on that half of the app when we only want three.

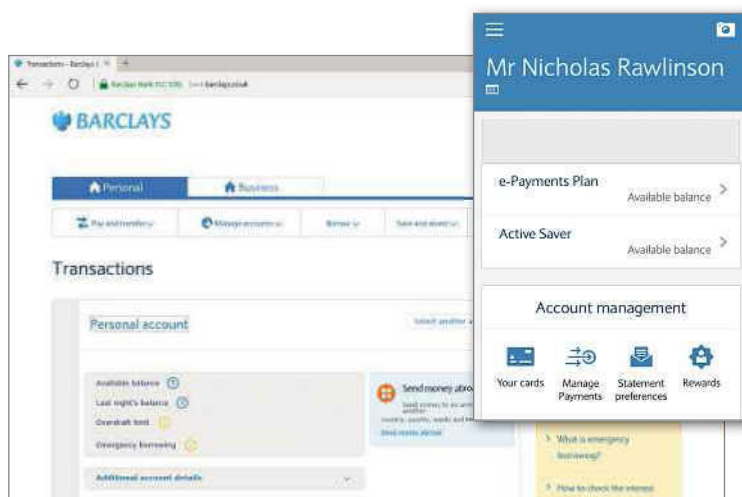
Barclays also offers built-in cloud storage. This isn't only for statements, letters and contract notes and so on from the bank itself, but also for any personal documents you might need

to keep close by while doing your online banking.

Aside from actually paying in cash and cheques, there are very few counter tasks you can't perform through the site, which takes international payments, reporting lost cards and managing a mortgage in its stride. You can even retrieve a forgotten PIN through the browser and set up bulk payments to make multiple transfers simultaneously, which would be useful if you wanted to set up equal payments to several children's savings or trust accounts. You can save the details of regular payees for quick access, but must authorise new ones using a card reader or app.

Statements are available as PDFs, and transactions can be downloaded in QBO and OFX format for importing into accounting applications. We're also pleased to see a CSV option.

To get the most out of the mobile service, it's worth downloading Barclays' banking app. The iOS version works with Apple Watch, for viewing transactions and locating



ABOVE It's hard to find a better-looking site or app than these



branches. It's also worth downloading the Pingit app for making quick payments. Pingit stores payee details, so if you need to settle a shared bill at the end of a meal, you can "ping" money to your friends on the spot and they'll receive a text to confirm that it's arrived.

The final sweetener is a year of malware and virus protection for two devices, courtesy of Kaspersky Internet Security 2016. You can upgrade to five-device cover from Kaspersky Total Security (our A-List choice) and Kaspersky Safe Kids for a one-off £7. All of this makes Barclays our top choice.

First Direct

A mature experience, with a good balance between convenience and security, but it's a little dull

SCORE ★★★★★

First Direct was among the first banks to offer 24-hour telephone banking back in the 1990s, and its experience stood it in good stead in the rush to online banking a decade later. Its website and apps are mature and feature-packed, and there's a host of extra services to support the core software.

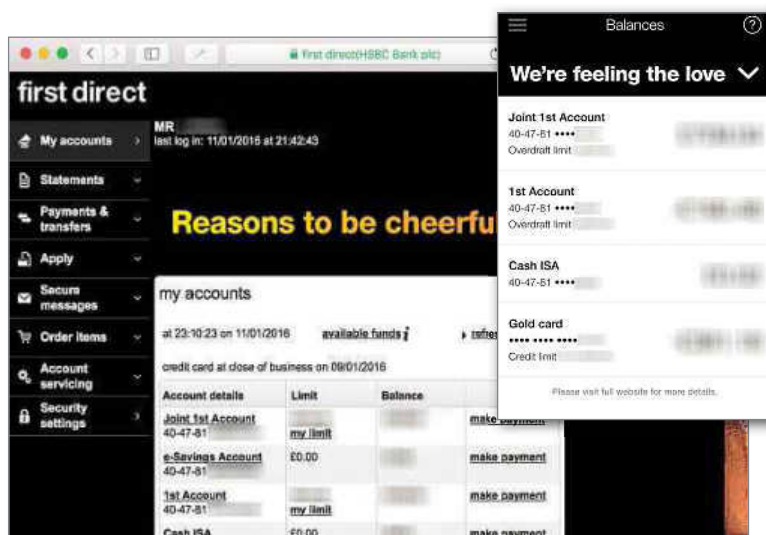
The website covers most of your banking basics, allowing you to make payments, set up standing orders, and even apply for loans and mortgages. However, it's light on extras. Beyond displaying your statements in a list and managing direct debits, there's very little to play with.

The First Direct Plus system looks promising. It aggregates account information from non-First Direct companies, including credit cards

and utilities, to give you an overview of your finances. But it's very fussy: you can't access the service from a Mac, and you need Internet Explorer and ActiveX for it to work on PCs. Come on First Direct, it's 2016, not 1996.

The app runs along similar lines. It's straightforward to use, displaying all your balances on a simple homescreen, and it's extremely easy to access the information on each account. Again, though, it's basic in terms of the features it offers. You can only transfer money to those you've made recent payments to. On iOS, we found the app crashed and frequently threw up error messages.

Furthermore, security is a mixed bag. First Direct doesn't force you to use a hardware or digital secure key – you can simply log in using your password and memorable question. However, if you want to do more than view your balances and pay known beneficiaries, you'll need to generate a digital secure key via the app, or



ABOVE The First Direct site and app are straightforward to use, but a bit basic

order and use the calculator-style fob. That's a decent compromise between convenience and security, but it could be better. Despite the fact that First Direct supports Apple Pay, there's no Touch ID integration for its iOS app.

First Direct's online banking offering is comprehensive, but for all the bank's experience, its software offerings lack elegance and flexibility, particularly on the mobile side, and there's nothing on offer for those who want a more visual representation of their money.

Halifax

Halifax trails its rivals for features and usability, with the app a particular chore to install and use

SCORE ★★☆☆

Despite a recent revamp, the Halifax online banking service leaves more to be desired than its interest rates. Login requires three separate pieces of information: a username (this can be saved on the computer), an alphanumeric password, and three digits from a piece of “memorable information”, which is performed using dropdown menus to thwart potential keyloggers. The login is then delayed by a splash screen advertising the latest Halifax promotion before you finally get to the guts of your accounts.

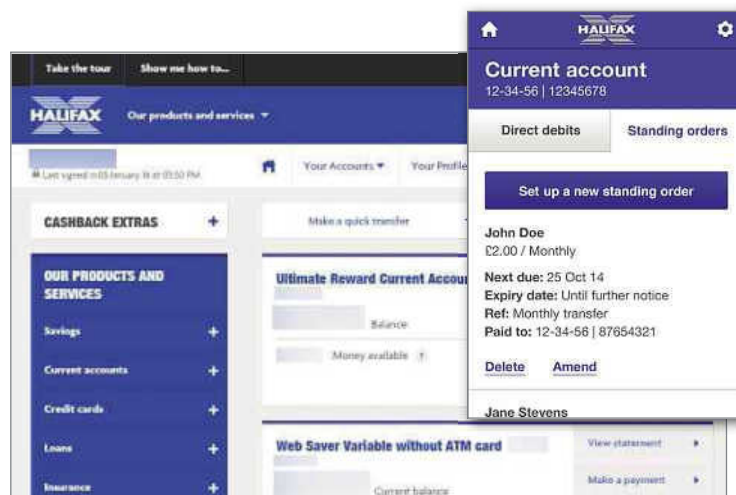
The main screen gives you clear snapshots of all your balances, as well as shortcut links for viewing statements and making payments or transfers, but there’s little in the

way of power features. Scanning through statements is a button-clicking chore, but at least the search facility is well implemented: this provides the option to delve back in time and search for specific transactions from previous years (to check tax payments, for example).

Statement export options are more limited. You can only ship out 150 transactions at a time and you’re restricted to CSV and QIF formats. If you’re trying to send a year’s worth of statements to a personal finance package, best take the day off.

Approving payments to new recipients is smooth: Halifax calls your mobile or landline and demands you enter the four-digit number shown onscreen before approving transfers to new payees, helping to prevent fraud.

Such payments can also be approved via the bank’s mobile app, but installing this on our Android handset was an enormous pain in the backside. Installation was botched no fewer than four times, as the app



ABOVE The main screen of Halifax’s site gives you clear snapshots of your account balances

failed to accept the four-digit authentication code provided in a phone call from the automated voice system. Worse still, our voicemail inbox was subsequently clogged with automated messages, Halifax seemingly attempting to place two simultaneous calls every time we tried to set up the app.

Once installed, the ugly app is no more than perfunctory, its best feature being a cashback system where you can earn discounts for shopping at selected high-street retailers. We’d rather have a snappy, feature-packed app than a poor man’s version of Quidco, though.

HSBC

Neither flash nor fast, but HSBC covers all the key features while keeping a tight eye on security

SCORE ★★☆☆

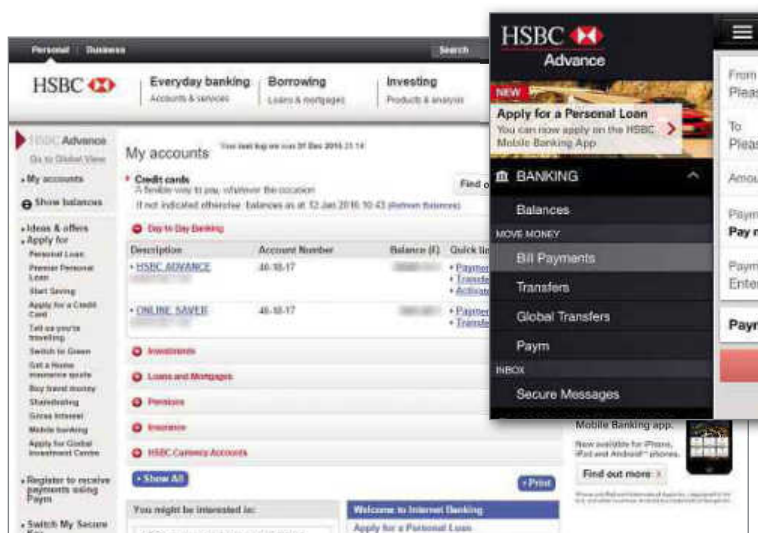
Years after its rivals, HSBC has finally produced a fully fledged app. And it’s, well, okay. One nice feature is Fast Balance, which lets you check your current account’s balance from the homescreen without logging in. However, it’s optional, just in case you’re worried who might grab your phone.

The app’s money-management features are limited to basics such as paying bills and transfers to accounts already set up via the website. You can also make instant payments using Paym (paym.co.uk), but the recipient must also be set up on the service. Note that the iOS app isn’t native and so can be aggravatingly slow to load pages: frustrating when you want to do something in a hurry. Likewise, no Touch ID support is a real pain.

Identical security measures are in place if you want to log in via the app or online. You will need your 12-character username (which can be saved by the app or the browser) to answer a simple security question of the name-of-first-pet ilk, and then enter three randomly chosen characters from your password.

There used to be a physical key to generate passcodes, but HSBC is now pushing people to using the app.

As each year passes, HSBC makes more and more services available online, to the point where there’s now very little you can’t do. Stop a cheque, request a change to your overdraft, download your annual summaries, let the bank know you’re heading abroad – the list goes on. Although the menu system lacks elegance – HSBC basically chucks every link imaginable down the left-hand side of the window – it’s quite easy to find what you’re looking for.



ABOVE There’s very little that you can’t do on HSBC’s link-loaded website

HSBC also offers a year’s free subscription to McAfee VirusScan Plus, an offer it claims would cost £39.99 “in the shops”. However, our recent tests (see issue 257, p92) show that McAfee is little better than Microsoft’s free Security Essentials when it comes to virus detection. The final feature, if you still use Quicken or Money, is that you can download statements in QIF, CSV and OFX.

In truth, there’s nothing standout in terms of features or functions, but it’s a respectable offering from a bank that follows rather than leads.



Lloyds

A mature offering: whether you're using a phone, tablet or your desktop PC, there's little you can't do

SCORE ★★★★★

Lloyds was one of the first banks to offer an app. Well, sort of. Back in the 1990s, while other leading banks were dipping their toes into web-based banking, Lloyds created its Electronic Chequebook system, which ran on the Psion 3a pocket organiser.

Nowadays, of course, Lloyds offers a full basket of online banking tools: a web-based banking facility that also adapts to mobiles and tablets, as well as Android and Windows Phone apps, and separate apps for iPhone and iPad.

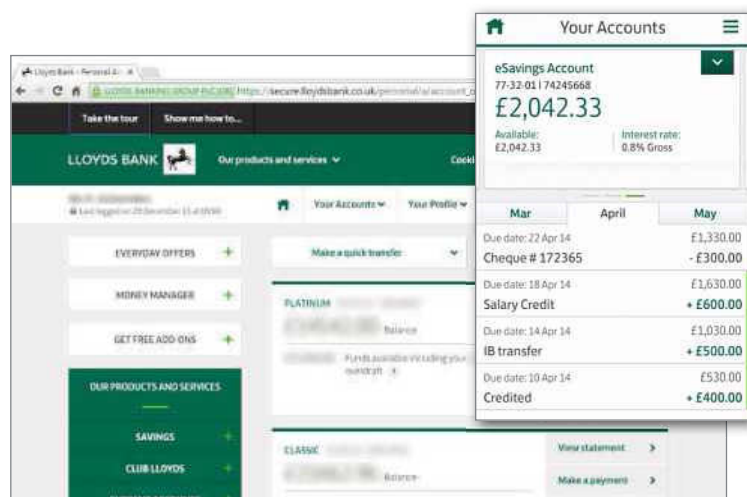
Actually, on the iPad, "app" is a slight misnomer, as it's simply the normal website wrapped up in an app layer. It does at least adopt the login facility from the other apps, where once the device is registered

with Lloyds, you can log in with only three randomly chosen characters from your passphrase.

Both the Lloyds apps and website are fully featured, giving access to all of your accounts including those where you are a joint signatory, and allow all of the normal banking activities such as paying bills, transferring money between accounts, managing standing orders and direct debits.

One surprising weakness is in searching transactions. On the website, you can only search three months at a time, which is a real pain when you come to do your tax return. Dafter still, on the mobile version of the website and the various apps, there's no search facility at all. That can be really frustrating.

The website provides a useful Money Manager facility that shows a breakdown of your expenditure across various categories, a calendar of when outgoing bills fall throughout the month, and facilities to set up



ABOVE Both the apps and website are fully featured and give access to all accounts



savings goals and spending plans. For people who struggle with budgeting, these are a great boon.

We also really like the text-alert facility. As well as sending you weekly balance updates, this will let you know if your account balance goes above or below predefined limits, or if your card is used for overseas transactions. Furthermore, you will be alerted if new payees are set up in the online bank.

Apart from the silly frustration with searches, we really like the Lloyds offering. If your existing bank is lagging behind, it may well be enough to persuade you to switch.

Nationwide

Nationwide's online service hasn't changed much, but it's moved with the times when it comes to apps

SCORE ★★★★★

Nationwide Building Society has a reputation for being dependable. Its online offering provides an experience that's just that, even if it isn't exactly one to get pulse racing – but then what banking service does?

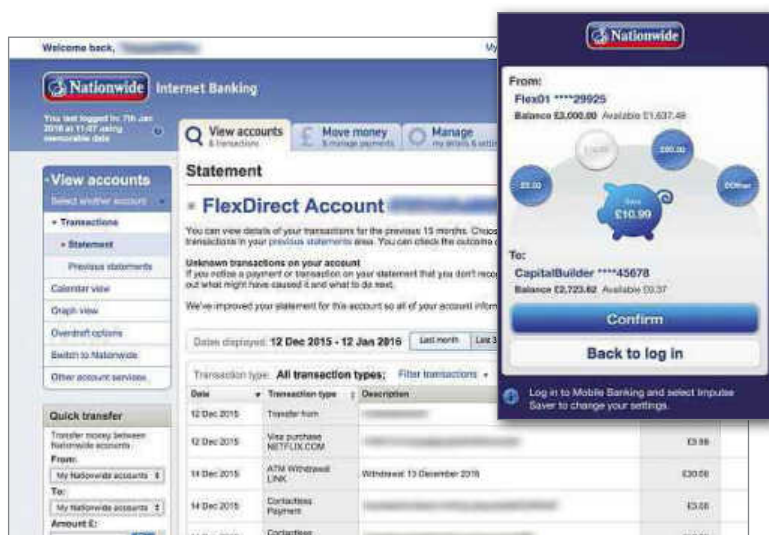
It feels like little has changed in Nationwide's online banking over the past decade, albeit in a pleasantly familiar way. The traditional blue colour scheme is the same as ever, although you now have the choice of three marginally different themes, and it's maintained its simple navigation and swift interface.

Nationwide customers are provided with a card reader, but you don't need it to log in if you prefer to use your private credentials. No doubt aware of the fiddliness of the

card reader, it's only compulsory for big transactions or those you haven't paid before, allowing small transfers to friends to pass instantly without unnecessary scrutiny. Security feels tight enough, though, and you can even set a personal message to appear on the site to catch out possible phishing imitations.

There's no option to buy travel money, but everything else is present and accounted for, including the ability to apply for loans and savings accounts, change your address or let the bank know that you're abroad so it can relax its eagle eyes for the duration of your trip.

The app is a relatively new addition to the Nationwide stable, and offers parity between both provided flavours: iOS and Android (there's no Windows Phone app). They let you check your balance without logging in, and a neat feature called Instant Access Saver allows you to move small amounts into savings without a passcode, should you skip your



ABOVE Nationwide's reassuring blue and white colour scheme is the same as ever

morning coffee and want to bank it before you change your mind.

More in-depth account checking is available by entering three digits of your passnumber, but perhaps the most impressive feature is that smartwatches are supported in both apps, allowing you to quickly see your balance from your wrist – or even be sent a daily buzz should you feel brave enough.

There's nothing remotely world-changing here, but Nationwide's desktop and app offerings are solid, smart and dependable.

NatWest

Concentrates on speed and simplicity, whether online or in the apps, with tight security for good measure

SCORE ★★★★★

NatWest's strong apps heritage shows: not only does it support every major mobile OS, but it has a features list that towers above most rivals. It does the basics – you can check account balances, monitor direct debits and standing orders, transfer cash between accounts and pay bills – but it also lets you top up a pay-as-you-go mobile and withdraw cash from a cashpoint without your card.

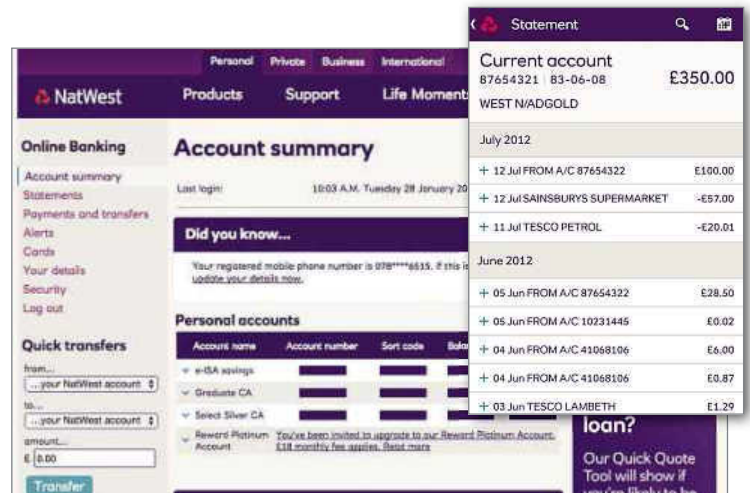
The iOS version also supports Apple Pay, both on iPhones and the Apple Watch, and you can use the Touch ID fingerprint sensor to quickly log in without a password. The apps are native on every platform, so are quick to load and have a simple layout.

Accessing your account via the website is more convoluted. You

need a ten-digit customer number (which Chrome refuses to save for return visits), a numerical PIN and an alphanumerical password. You will also be asked for specific characters from the PIN and password to protect against keyloggers.

Once in, the website offers everything you would expect. Arrange and change overdrafts, with a calculator indicating the costs; order a compact card reader for making secure payments; let the bank know when you're going abroad to prevent your card from being blocked. You can also download your annual statements in a range of formats, including Money and Quicken, with OFX and CSV formats on offer too. The interface is straightforward, with separate tabs for budgets, financial services and alerts, as well as a "quick transfer" widget available on every page for instant payments.

NatWest recommends that customers download Trusteer Rapport software, which authenticates a website's security certificates when you're banking,



ABOVE NatWest's website isn't the flashiest, but it gets the job done



but uses very few system resources. It's by no means unique to NatWest, but it's great that you can install it alongside your preferred antivirus.

NatWest doesn't have the flashiest online banking portal, but it certainly gets the job done. Meanwhile, the apps are more attractive and rapidly catching up the website in terms of features, meaning you now do almost all your banking on the move. Scottish customers should note, however, that (as with NatWest's parent company, the Royal Bank of Scotland), their accounts will transfer to the new brand Williams & Glyn at some point in 2016.

How Midata can help you move to a new account

The idea behind the government's Midata initiative is simple: it anonymises your data so that you can safely upload it to a price-comparison site and find out which is the best deal for you. Theoretically, you could use this for almost any service – utilities, phone deals, financial services – but its first incarnation encourages people to find their ideal current account.

Certainly, we need encouragement. According to Gocompare.com, the first comparison website to offer a Midata-based service, only 6% of consumers switched accounts in the first nine months of its launch. That's despite the introduction of the seven-day-switch guarantee in late 2013. Indeed, according to a Gocompare.com survey, 40% of adults have never switched from their first current account.

Midata is a voluntary scheme and, at the start, only six banks had signed up, but now almost every major UK bank offers an option to download it. You'll just need to do a bit of hunting to find it. For example, HSBC customers should head to My Accounts and select "Recent transactions". Hitting "Download transactions" will reveal an option where you can download your Midata.

Several steps have been taken to strip the data of anything that could identify you. For example, the file won't contain your name, address, sort code or account number, and certain transactions that aren't considered relevant will be blanked out. If you're interested, you can also look through the file to see exactly what's being sent.

To create your own, personalised comparison table, you should upload your file to Gocompare.com's service at pcpro.link/258midata (this is also a good place to check if your bank does support Midata – select the dropdown for your bank, and you'll either be prompted to upload your file or told your bank doesn't support Midata yet). Note that it took several minutes for Gocompare.com to build our table, so prepare to be patient.

All the recommendations are based on the different banks' fees, interest rates, cashback offers, incentives and charges. Naturally, it's all using existing

The image is a screenshot of the Gocompare.com website, showing a comparison of current accounts. The table lists three banks: First Direct, Halifax, and Santander. For each bank, it shows the potential value, interest rate (APR), authorized overdraft, and switching incentive. The table also includes a 'Representative Example' for each bank, showing the estimated value, interest rate, and switching incentive. The table is titled 'MIDATA: What is Midata?' and includes a link to 'MIDATA: What is Midata?'.

Bank	Potential value	Interest rate (APR)	Authorized overdraft	Switching incentive
First Direct	£100.63	0%	15.9%	£125.00
Halifax	£33.00	0%	0%	£100.00
Santander	£23.81	0%	18.85%	£150.00

data, so the algorithm does assume that your future spending patterns will match your previous ones.

Nevertheless, it's a great way to check if your current bank really is the best choice for you. We look forward to Midata spreading to many other services in the years to come.



How to bank safely on your mobile

Accessing your bank on the move can open up all sorts of ways for hackers to steal your money. **Davey Winder** explains how to stay protected

Mobile banking is now more popular in the UK than via a PC – and twice as popular as going into a local branch – so it's no surprise that cybercriminals are just as interested in hacking your phone as your laptop. However, let's not get paranoid. This doesn't mean hackers are changing their modus operandi, and mitigating the threat boils down to some simple steps.

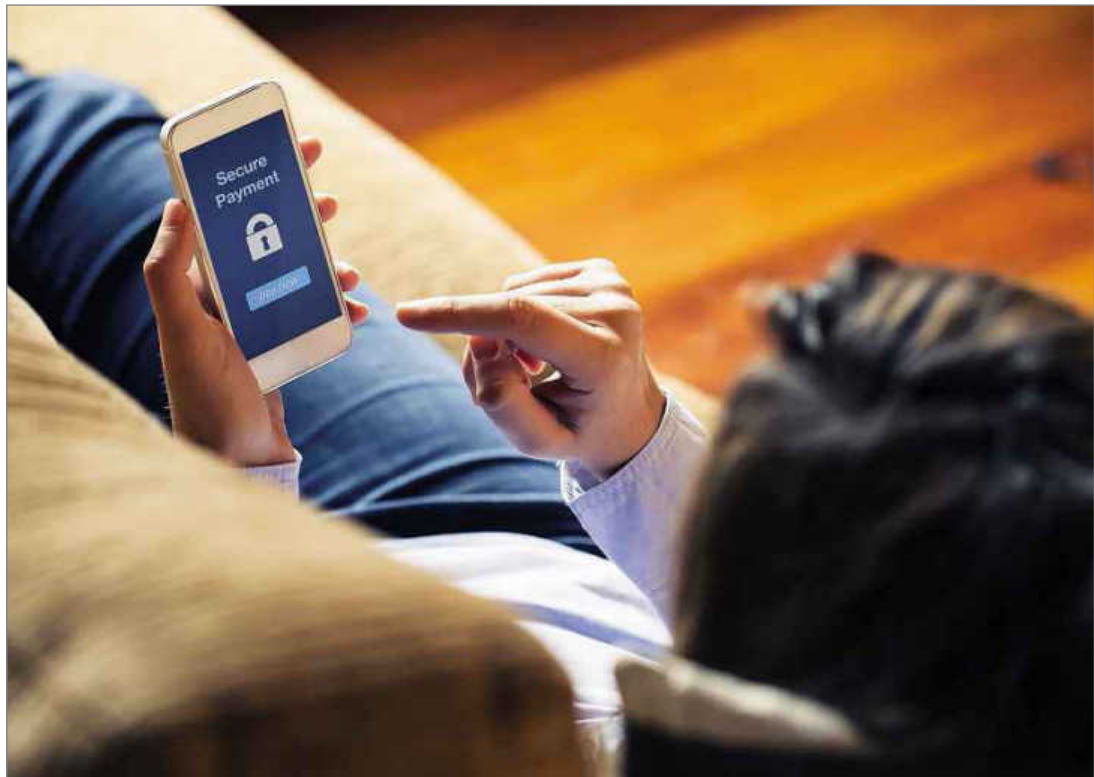
In fact, hackers don't need to change their approach much when it comes to attacking mobile banking instead of internet banking. The route of least resistance is still favourite and that usually means exploiting end user behaviour.

What has changed is the "attack surface", which has become larger with the move to mobile. While in the past attackers concentrated on exploiting badly written application code and social engineering, now there are devices and network connections to target as well.

■ Locking your devices

Let's start by looking at the devices themselves, which means the phone in your pocket. Whatever platform your device runs on, an old operating system is always going to bring greater risk when banking than an up-to-date one. By the nature of Apple's upgrade system – the fact there's only one version of the OS and how hard Apple pushes each update – an iPhone is always going to be more secure than the average Android phone, especially if your Android device runs a version specific to your vendor. Unpatched vulnerabilities are far more prolific on older versions of Android, and will likely stay unpatched. Your first step should be to always check for updates.

Then there's locking the device. The number of people who sacrifice security for the convenience of not having to enter even a four-digit lockscreen PIN is remarkable. Yes, most banking apps will require a username/password combo to log in, often with some form of secondary authentication, but these may only delay the hacker. With full access to the phone, a smart hacker will be able to garner information from contacts, email and social networks that may point to the username and passwords.



Mitigate the risk by enabling the lockscreen, preferably with a password or a "long PIN", rather than the default four-digit one. If a device is fingerprint-enabled, use this to keep attackers out. Also, make use of any remote lock and wipe functionality that the mobile platform provides. If there isn't any, consider the peace of mind offered by third-party software and services such as Avast (*opposite*).

■ Lock down your network

Network connections are even more problematic, and insecurity comes down to the convenience factor. If a phone isn't getting a decent cellular signal it will switch over to Wi-Fi where available, and in a coffee shop that's likely going to mean an unsecured public hotspot. Or worse.

Yes, worse. Hackers are adept at setting up their own open hotspots with plausible names for the location. If an unsuspecting user connects to one of those then their data will be logged and credentials copied when logging in to check a bank balance or transfer funds.

Not that genuine Wi-Fi is so much safer, because the hacker can easily

ABOVE Whatever platform you're on, an old OS is always going to bring more risks than an up-to-date one

"sniff" any traffic being sent across it using readily available tools. To mitigate this, the best solution is the most obvious one: don't use public Wi-Fi to connect to mobile banking. Disable Wi-Fi on the phone before setting off so that only the more secure cellular network connection is an option.

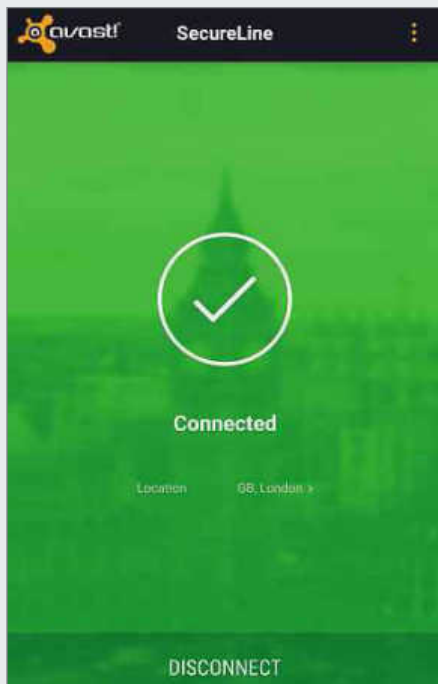
If banking while you drink is unavoidable then make the connection via a VPN client (*see opposite*) so that all the traffic goes through an encrypted tunnel and prevents criminals from intercepting the data.

"Mitigate risks by enabling the lockscreen, preferably with a password or 'long PIN', rather than a default four-digit one"

■ The apps

I haven't even mentioned the mobile banking apps themselves yet. There's a reason for that, though, as on the whole, they're pretty secure. That said, pretty secure isn't the same as airtight. When IOActive security researcher Ariel Sanchez decided to revisit his 2013 research last year (pcpro.link/258bank), he discovered that mobile banking app security had improved greatly, but still had some way to go.

Three security apps to complement mobile banking



Avast SecureLine



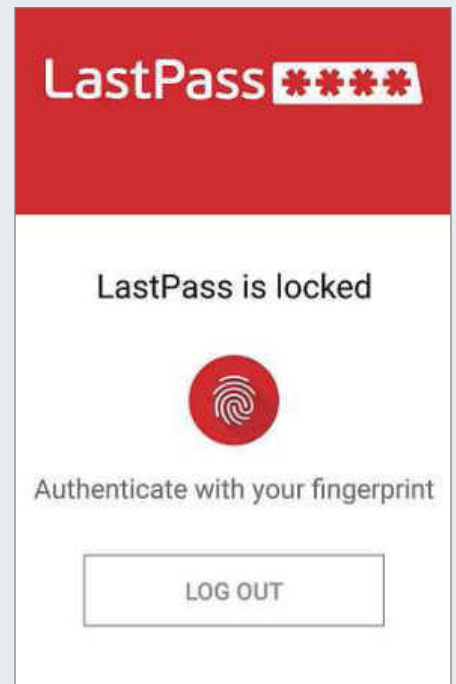
I believe a virtual private network (VPN) app should be installed on every phone. There are plenty to choose from, ranging from free to extortionate annual subscriptions. Which you choose may well depend upon device and platform availability, but paid-for apps will generally be faster and more stable in use. A good mid-range option is Avast SecureLine, which I've found to be reliable, easy to set up and use, and costs £14.99 per year. £1.25 per month is decent value to ensure that nobody is snooping on your online banking, especially when using unsecured public Wi-Fi hotspots.



Avast Antivirus & Security



Additional layers of security for your mobile device are never a bad bet. The sting is taken out of mobile antivirus a little by this Avast app for Android, which offers free protection, including malware scanning (SMS), SMS filtering, app privacy reporting and a web shield to block malware links. There's also a "premium" upgrade for £12 per year, which is more about protecting your phone against theft, including remote data recovery and remote photography of the thief. However, the free core protection is perfect for hardening your device when banking.



LastPass



The importance of strong passwords can never be emphasised enough, along with not reusing the same password across multiple services. Apps such as LastPass, which is free in its basic form, will not only generate a strong password for each banking application, but save them in a securely encrypted vault. Access to the Android version, for example, can be authenticated first by fingerprint (if available on your device) and then by a two-factor-authentication code from Google Authenticator for good measure.

The "good" news: 42.5% of the apps provided an alternate authentication method. The bad news: 35% of them contained non-SSL links. This makes it easier, in theory, for an attacker to intercept traffic and inject arbitrary JavaScript code to launch fake login prompts. That's another good reason to always use a VPN when banking on a mobile device.

Then there's the login credentials, which should be as strong as possible, meaning the usual strong password construction advice applies. Most apps will apply a secondary form of authentication before access is granted, which may come in the form of a code generator, either as a separate device or built into the app.

The latter may seem like security suicide, but the code generation will be protected by another password (different from the account login) and it's more to prevent man-in-the-middle or malware attacks where

the criminal doesn't have physical access to the phone. Using this "something you know" (login/password) and "something you own" (code generator/phone) approach to account access has vastly reduced the risk of mobile banking. That the banking password shouldn't be reused elsewhere goes without saying, but the fact that I'm still saying it speaks volumes.

All of this assumes that we're talking about genuine banking apps in the first place. Clones, or the real thing with added malware, can Hoover up login details and empty accounts with little fuss. The mitigation here is to use the official app store for each chosen platform. Downloading apps from an unofficial source to a rooted device is just playing into the hacker's hands.

The same goes for non-banking apps, which can reduce the security of banking, especially if they contain malicious components. Innocuous-

looking apps that have had their app permissions clicked through without reading could have sideloaded a keylogger or other malware that will capture credentials.

■ What else can you do?

There is plenty of debate as to whether

an antivirus or security package is necessary for smartphone users, but for the relatively small outlay (most cost a few pounds per year at most, some are free) it makes sense to adopt the better-safe-

than-sorry approach. Mobile security packages are best for monitoring background activity, filtering dangerous SMS messages and even checking the privacy implications of the apps you have installed. Coupled with sensible use and up-to-date banking apps, there's no reason why the hackers should win.

"That banking passwords shouldn't be reused goes without saying, but the fact that I'm still saying it speaks volumes"



Royal Bank of Scotland

An early online banking adopter and still at the cutting edge when it comes to embracing new features

SCORE ★★★★★

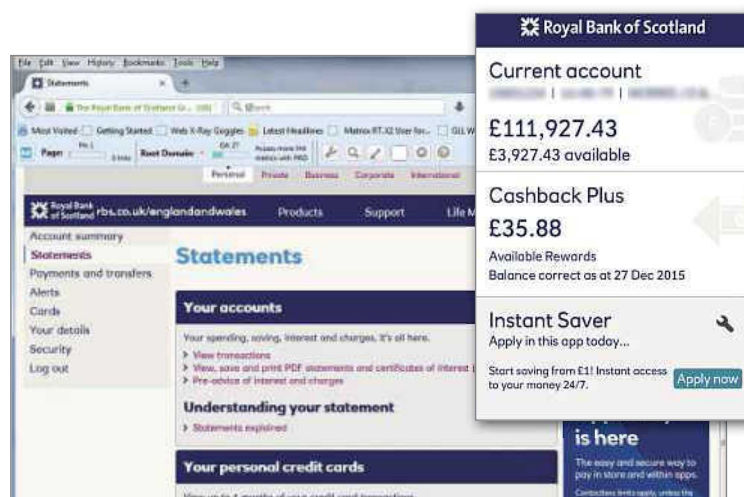
The Royal Bank of Scotland's history may date back to 1727, but it was one of the first to embrace online banking. It's also one of the few to offer apps for all the major mobile OSes, including Windows Phone, and some of these have been available for years. We're pleased to see support for the latest hardware developments, too: if a fingerprint reader is available on your phone then it can be used to log in to the app (or you can use a PIN).

On an iPhone, the app can perform most banking functions, including checking your statement, paying bills and managing direct debits or standing orders. There are extra capabilities such as using a passcode

to obtain cash from a machine without your card, top up mobile phones and pay people with the Paym (paym.co.uk) service. The one thing you can't do is set up any new payees. For this, you still need to use the browser-based online banking.

Certain banks now use mobile phone codes to add a second level of security when setting up a new payee. However, RBS still uses a physical reader, your cash machine card and your PIN. Simply logging in to your bank online requires a user ID, plus selected numbers from your passcode and letters/numbers from your password. These are randomly chosen and never include the full set of characters, so even a keylogger on your system won't record all the necessary details.

Aside from a couple of quirks, the website is easy to use and comprehensive. For example, you can download statements for up to seven years as PDF but, confusingly, the ability to export statements to other formats has its own section. Another separate section provides



ABOVE Aside from a couple of odd quirks, the RBS website is comprehensive and easy to use

Midata downloads. Impressively, you can set up an Instant Saver with "five clicks", and perform all the usual payment, direct debit and standing order functions, including international transactions.

The app doesn't offer as many features, but it's native (so faster than HSBC's app) and easy to use.

It adds up to a complete digital banking provision, with no major omissions from the website or app. Our one note of caution is that RBS is about to spin off its personal banking service as Williams & Glyn, meaning its future course is more difficult to predict.

Santander

Secure and well designed, Santander's website and apps are on the money – if you use iOS or Android

SCORE ★★★★★

Santander's websites and apps have become so all-encompassing that you'll rarely find yourself having to visit a high-street branch or even call the customer-service line.

Logging in is secure, too. Not only are you asked to enter three characters from your security number (also used for phone banking), you also have to enter three characters from your longer password, which is only used for your online account. As reassurance that you're not being phished, you're shown a unique memorable word and picture every time you log on to prove you're connected to the real Santander website and not a fake.

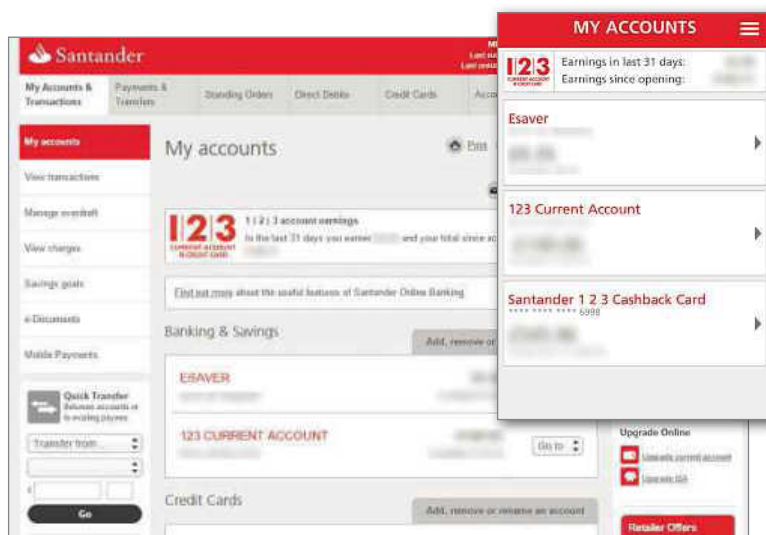
Menus on the left and top of the page give access to everything else

you might need, including standing orders, direct debits, account details and overdraft applications. You can apply for other services too, including savings accounts, credit cards, loans and even a mortgage.

Any changes you make to your account – such as amending a standing order – must be authorised with a one-time use code, which is sent via SMS. It's a faff, but worth it for the additional layer of security. For the money-conscious, Santander lets you set up account alerts, which will send you messages when your balance goes below a figure you define.

The Santander mobile app is only available for iOS and Android and there's no responsive mobile site, which is a big disappointment and the only major shortcoming of the Santander service.

The app only requires three random characters of your security number, making it quick and convenient to log in when you're



ABOVE Santander's website and app are so all-encompassing that you'll rarely have to visit your branch

on the move. There's also plenty to do inside the app, including transferring money between your accounts, making payments to previous recipients and applying for other Santander products. You can't pay your Santander credit-card bills from the app, though, which is a minor gripe.

Santander deserves a lot of credit for its roster of services and apps: they're easy to use, fast and have most of the features you could demand from an online bank. It's a superb package indeed.

Smile

Smile's simple site is a breeze to use, but be sure to download the app if you want to bank on the go

SCORE ★★★★★

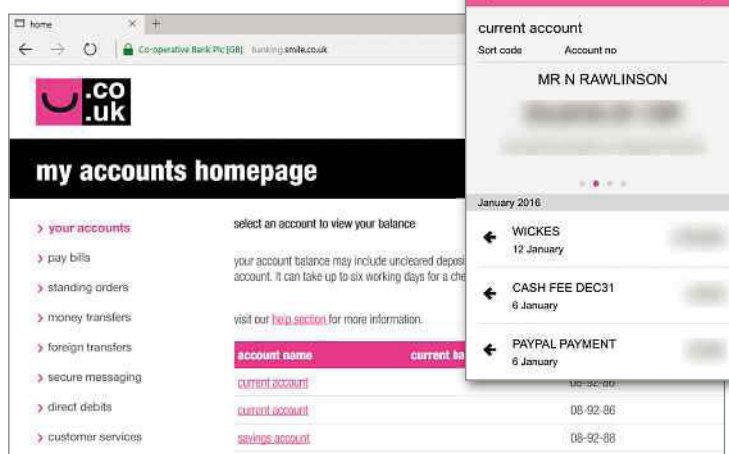
Smile's recent redesign looks great. It's utterly devoid of frills and very easy to navigate, with intelligent use of colour picking out important details such as links and your net worth (it deducts your credit-card debt from your overall, combined account balances to give you a more realistic idea of what you can spend).

Logging in takes three steps on three separate page loads, and requires your account details, two digits from a PIN and a piece of memorable information. There's no need to use an app or hardware reader to generate a login code, but you will need a reader, and your credit or debit card, to authorise new payments once you're inside the website.

Smile provides apps for iOS, Android and BlackBerry, through which you can inspect your balances, transfer money, pay bills, set up alerts and read secure messages. You can also find your closest branch of the Co-operative Bank (of which Smile is an offshoot) and call customer services by tapping the department you need. Setting it up is a breeze, requiring only that you have your account details to hand and can accept a code sent via SMS on the device you want to use for online banking.

If you want to bank on the move, the app is a must. Unfortunately, the Smile website isn't optimised for small displays, meaning you'll need to constantly zoom in and pan around if you want to actually read anything.

You can set up, amend and cancel transfers, direct debits and standing orders through the site, and perform a range of customer-service operations such as ordering a new chequebook, stopping a cheque or disputing a transaction. All of this



ABOVE Smile's very intelligent use of colour picks out key details such as links and your net worth

means that there's rarely any need to get on the phone. If the preset functions don't satisfy your needs, there's an integrated messaging service, too, which we've always found to be responsive, usually dealing with enquiries in 24 hours or less.

However, most disappointing is the inability to download statements in any useful data format: no CSV, QBO or OFX. Your only option is PDF, which is fine for archiving, but not much else. If you don't need this feature, or own a Windows Phone, Smile is indeed a pleasure to bank with.

View from the Labs

Why are most of us still blindly loyal to our bank?
Editor-in-chief **Tim Danton** urges you to switch

It's been three years since we last compared all of the different banks' online offerings, but if I was to guess how often the "average" (always a dangerous word) reader has switched provider, I'd say zero. Certainly that's true for me.

I've been a loyal HSBC customer for more than 25 years, although when it lured me in with a "£50 free cash!" offer, it was called Midland Bank. If I try and cast my mind back to what made me choose, bearing in mind all the banks at my campus university had such offers, I think I was probably enticed by its location: two minutes' walk away from my halls? Done.

In stark contrast with all that time I've stuck with HSBC, I've spent my adult life hunting through the best deals for electricity suppliers, broadband providers and even water companies with a promiscuousness that, in comparison



Tim Danton is editor-in-chief of PC Pro and is now voting with his feet

at least, makes me look quite the stud.

So why, I ask myself, this blind loyalty to my bank? It's not as if it hasn't tried my patience on numerous occasions. Punishing overdraft fees, parsimonious interest rates, penalty fees, £25 costs for sending me a letter telling me about those penalty fees. And now, having edited this comparison of all the different banks, I realise just how stupid I've been when putting up with an online service that's consistently behind the best.

"The number of times I go into a physical branch now pales in comparison to how often I check online or switch on the app"

I need to put on my most rational hat and realise that this matters to me: just now, sitting in Gatwick Airport, I couldn't alert the bank



to the fact I was going abroad via the app, but had to log in via my laptop instead. That's okay on this occasion, as I happen to have my laptop with me, but what if I'd been caught without in the departures lounge?

I'm sure I'm not alone in putting up with mediocre services. The number of times I go into a physical branch now pales in comparison to how often I check online or switch on the app, and if I was to draw a rational list of pros and cons it would look totally different to my list from 1990.

It's time for all of us to vote with our feet, and it's now ludicrously easy to do so. I advise you to do the same – even if it breaks with a decision you made decades ago. ●

The Network



Practical buying and strategic advice for IT managers and decision makers

The Business Question

Does your business need an app?
Our experts have the answer **p102**

Cheat Sheet

How to properly understand the
threats to your business **p104**

Essential admin tools for SMBs

How to make the most of
administration software **p106**

BUSINESS FOCUS

Choose the right small-business router

There are plenty of small-business routers that deliver key features at affordable prices. Dave Mitchell subjects four contenders to real-world testing

Small businesses relying on consumer-grade routers are making false economies and putting themselves at risk. There may be a plethora of cheap and provocatively designed home routers on the market, but few have the features businesses need to deliver secure and reliable internet, or remote access to their staff.

Most consumer routers focus on providing superfast wireless services with everything else taking a backseat. Apart from that all-essential firewall, you'll be hard-pushed to find business features such as bandwidth controls, WAN redundancy, virtual private networks (VPNs), quality of service (QoS) or web filtering.

The good news is there are plenty of business routers that deliver many of these at affordable prices. True, you won't get the latest 802.11ac wireless, but what you will get is the peace of mind from knowing your business and users are secure.

This month, we've rounded up four small-business routers from well-established names, namely Billion, DrayTek, Linksys and TP-Link. They tick all of our checkboxes for features, and with prices starting

from as little as £144 exc VAT, they won't dent profits.

If you're using the router's LAN ports to network your servers and users together, only Gigabit will suffice. Dirt-cheap routers with 10/100 Ethernet ports should be avoided because they'll bottleneck activities such as file sharing.

If internet access is the lifeblood of your business, you should make sure it's always up. You should consider routers that offer multiple connections such as dual Ethernet WAN ports, integral ADSL2+ / VDSL modems, embedded

BELOW The dual WAN ports on the Linksys LRT224 support failover and two load-balancing schemes

4G LTE devices or even 3G/4G USB modems.

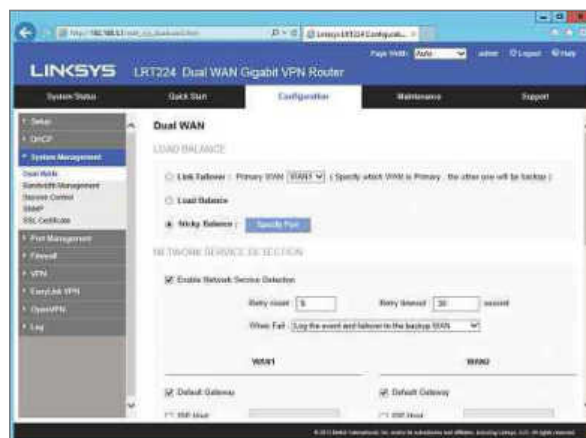
Failover is the cheapest way to provide WAN redundancy as the router will only use its backup link when the primary one fails, which is handy if the secondary link is a mobile device. Check that the router can regularly test the secondary link and, when using multiple internet connections, ensure you also use different service providers.

Wireless in the house

Wireless services aren't a priority for budget-priced business routers and it will invariably be the basic 2.4GHz 802.11n variety anyway. That said, most routers allow you to create multiple SSIDs, each with their own encryption schemes, meaning you could have one wireless network for staff and another for guests.

Guest wireless networks add a professional touch that will impress visitors, but security must be even tighter. Check out wireless routers that support client isolation, which will stop your guests from seeing anyone else on the wireless network and LAN.

If you do provide guests with internet access, you may want



to consider presenting them with an acceptable-use policy (AUP). For example, DrayTek's Vigor 2860Ln can redirect users on specific wireless SSIDs to a custom web portal.

Virtual networks (VLANs) are another valuable feature and allow you to segregate network traffic. A standard feature on most business routers, VLANs can ensure sensitive information is only accessible for those systems that need to see it.

Virtual private nightmare

A feature that most consumer routers don't have is virtual private networks (VPNs). These allow businesses to link separate offices over encrypted tunnels and provide secure access to LAN services for remote workers.

IPsec VPNs are still a top choice for secure site-to-site links. Included in the router, these are standards-based so should work across products from different vendors.

Client IPsec VPNs are far from straightforward, since remote workers need a software app to communicate with the router. Most budget-priced routers don't include any client software, meaning you'll need to source this elsewhere.

Open-source clients such as Shrew Soft (shrew.net) are free, but the downsides are slow development

and a lack of support. OpenVPN (openvpn.net) is another possibility, but unless you choose the Linksys LRT224, you'll need to run the server component on a LAN system.

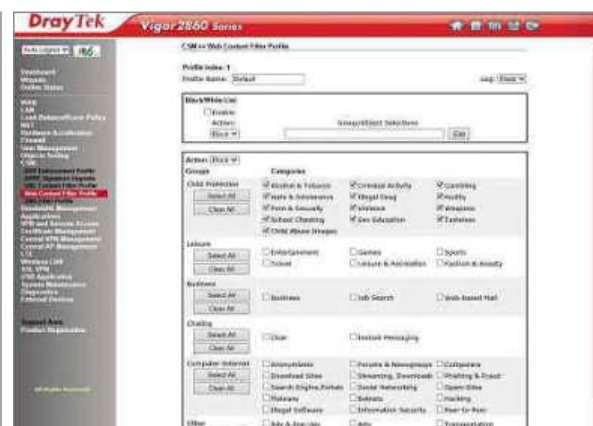
We think it's worth shelling out a few pounds for the TheGreenBow (thegreenbow.com) client. It's been updated to support Windows 10, it has decent documentation and we found it to be very amenable.

SSL VPNs are becoming more popular – they're far easier to deploy and use than the IPsec variety, only requiring a web browser on the client side. However, they're a rarity on small-business routers and heavy encryption overheads mean their performance is much slower.

Be aware that the processing power of low-cost routers will struggle with large numbers of VPN connections. When testing some routers, we saw their CPU usage go as high as 100% for a single VPN link.

Web filters and more

Be careful of routers that claim to offer web-content filtering. In many cases, this is nothing more than simple keyword or domain blocking. It's of very limited value, only allowing you to create lists that enable the router to check a website address and block access if it finds a match.



ABOVE DrayTek's optional web-content filtering is excellent value at £35 per year

True web-content filtering uses databases of URL categories, which are maintained in the cloud by third-party vendors. It's much easier to use – for example, if you want to stop staff playing games, you only need to block the category.

If you're using services such as VoIP, you'll want (QoS, which allows bandwidth for specific applications to be prioritised. Some routers also offer application blocking, where you can stop users wasting time on Facebook.

All routers have well-documented default admin passwords, so make sure you change them immediately. There is no point putting extra security in place only to leave the backdoor open. ➔



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For a limited time, get a **FREE SSD**
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all in a single storage pool



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Billion BiPAC 4500NZ

An affordable router with valuable 4G WAN failover and decent VPN performance

SCORE ★★★★★

PRICE £187 exc VAT from broadbandbuyer.com

Billion's BiPAC 4500NZ is a budget-friendly router aimed at small businesses looking for a solid combination of WAN redundancy, site-to-site and client VPN support, and wireless services. Its primary WAN connection is handled by a dedicated Gigabit port, and it has an integrated 4G LTE module that only requires a SIM card slotted in the back.

Installation is easy, aided by a wizard that runs through setting up internet access on the Gigabit or LTE WAN interfaces and enabling wireless services. It was quick to get these sorted, but you must remember to manually enable the router's SPI firewall as, rather worryingly, this is turned off by default.

WAN load balancing isn't available. For WAN failover, you must select it from the web interface and define primary and backup roles for both connections. The router probes a predefined IP address on the internet and, if it fails to get a response a specific number of times, it switches over to the backup link.

Wireless services are basic, only running to support for 2.4GHz 11n operations, but the router can present up to four virtual SSIDs

(each with its own encryption scheme), enforce client isolation to stop wireless users seeing each other, and use MAC address filter tables on each SSID to block or allow access for specific systems.

The router's USB 2 port doesn't support a 3G/4G dongle, but it can present a storage device to the network as an SMB share or FTP site. We could control access to the storage device by defining up to six user accounts to determine read and write access to the SMB and FTP services.

Performance is sluggish: copies over Gigabit using a share mapped from a USB stick returned read and write speeds of 8.2MB/sec and 4.5MB/sec respectively. The FTP speeds weren't any better with copies mustering 8.4MB/sec and only 2MB/sec.

Site-to-site IPsec VPNs are easy enough to create, but Billion doesn't provide any client software or tutorials, even on the more common third-party options. We tested using TheGreenBow VPN client and saw respectable real-world read and write speeds, with our copies returning 8.5MB/sec and 7.8MB/sec.

For PPTP VPNs, Billion provides guidance for Windows 7, which was easy enough to translate across to our Windows 10 remote desktop. As expected, performance was



ABOVE The 4500NZ has an integrated 4G LTE module that only requires a SIM card slotted in the back

lower than the IPsec variety, with file copies over a PPTP tunnel to our LAN systems averaging a top speed of only 2.7MB/sec.

Simple QoS rules can be used to prioritise particular services. Up to 16 rules can be used, with each defining a group of sources, destinations, ports and protocols and assigning high or low priorities.

Access controls to selected apps can also be enforced, although these are of limited value: Billion only provides a few options such as web, FTP, Telnet and Ping. Each rule can be applied to a range of IP addresses on the LAN or WAN and have a

time schedule applied to determine when it's active.

Its parental-control option supports Cisco's OpenDNS service for web filtering. The home-protection option

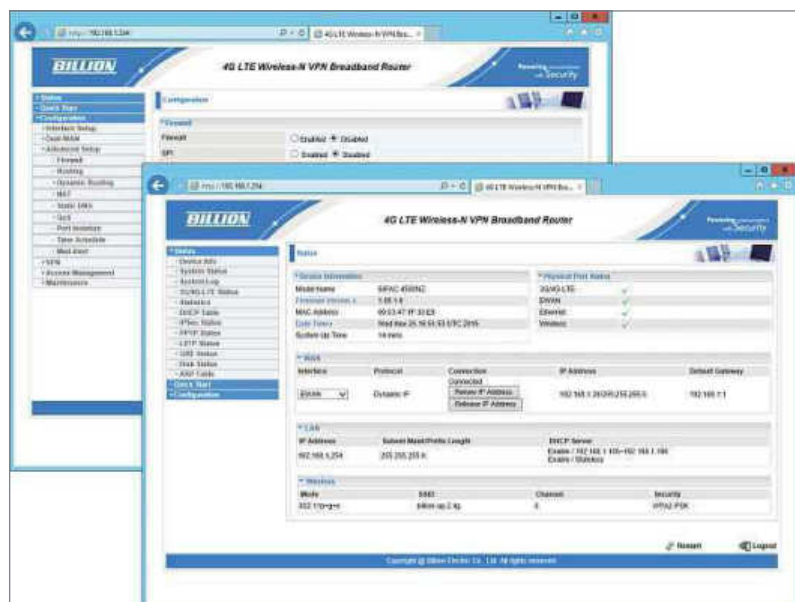
is free, but you'll need to modify the router's WAN settings to use the OpenDNS name servers and cough up around £13 per year to get usage logging and statistics.

VPN performance is reasonable, although Billion's documentation in this area is in dire need of a major overhaul. Even so, with Ethernet and embedded 4G LTE WAN support plus basic wireless services, the BiPAC 4500NZ is a good-value choice for a small business, as well as being compact and light enough to take on the road.

SPECIFICATIONS

Desktop chassis • 5 x Gigabit Ethernet (4 x LAN, 1 x WAN) • 3G/4G LTE with SIM slot • 2.4GHz 802.11n wireless • IPsec, PPTP, L2TP VPNs • USB 2 • external power supply • 230 x 43 x 155mm (WDH) • 2yr standard warranty

LEFT The router's web interface provides access to all features, but don't forget to turn its firewall on



DrayTek Vigor 2860Ln

DrayTek delivers a superb range of routing and VPN features, plus a WAN link for every occasion

SCORE ★★★★★

PRICE £349 exc VAT from broadbandbuyer.com

DrayTek's SMB routers have always focused sharply on WAN redundancy, and the latest Vigor 2860Ln has it by the bucketful. Along with an integral ADSL2+/VDSL2 interface, this curvy white box has a Gigabit WAN port, accepts a 3G/4G USB adapter and has a 3G/4G SIM slot around the back.

If that isn't enough, the 2860Ln is 2.4GHz 802.11n wireless-enabled, endowed with a standard SPI firewall and offers application controls, plus optional web-content filtering. We haven't finished yet, either: the router also supports 32 IPsec VPN tunnels and can manage up to five simultaneous SSL VPNs.

Installation is a cinch: wizards abound in the busy web interface, covering initial internet access, site-to-site and client VPNs, and wireless access. Up to 50 routing and load-balancing policies control traffic, allowing you to define sources, destinations and ports, choose the primary WAN link, and add the secondary interface you want it to failover to.

The SPI firewall is enabled by default and, along with protection against common DoS attacks, this

uses filters to control all manner of traffic. These are extremely versatile, with each filter comprising up to seven rules defining specific traffic and directions, applying a WAN load balancing policy and assigning QoS priorities.

The firewall filters go even further, catering for app-control and website-filtering policies. The former is a free service that we activated from our MyVigor account once we'd registered the router.

Along with plenty of IM and P2P apps, you can control various protocols, plus tunnelling, streaming, remote control and web apps. We created an enforcement rule for Dropbox, and once it had been added to the firewall filter it stopped users from logging in to their accounts.

Basic keyword-based website blocking comes as standard, but for £35 per year, you can upgrade to full URL category filtering. DrayTek employs the Cyren web service here, which provides more than 60 categories and, if users attempt to access a blocked site, they'll get a warning message.

Wireless services only extend to the 2.4GHz 802.11n variety, but the router supports up to four virtual SSIDs. Each can have its own encryption scheme, app- and web-filtering policies, rate limits in kilobits per second and even quotas that only allow wireless clients so many hours access per day.



ABOVE DrayTek's curvy white box has a Gigabit WAN port and a 3G/4G SIM slot around the back



DrayTek's SSL VPNs are basic, but they worked for us when provisioning secure remote RDP, VNC and SMB access to our LAN systems. Choosing SMB from the user's web portal provides a simple Explorer-style interface, although the best copy speeds we saw were around the 1.3MB/sec mark, with the router's CPU hitting 88% utilisation.

DrayTek doesn't provide any software for IPsec VPNs, but the router worked perfectly with TheGreenBow client. We had a 3DES IPsec VPN tunnel established in seconds on a Windows 10 remote desktop and saw reasonable performance, with our copy tests returning a rock-steady 7MB/sec.

The USB port can also present storage devices as SMB shares or as an FTP site, and users each have a home directory plus read and write privileges. SMB copy speed wasn't outstanding, with our tests returning

6MB/sec, but you can use the USB port to house DrayTek's thermometer dongle instead, and keep an eye on ambient temperatures from the router's web console.

The Vigor 2860Ln

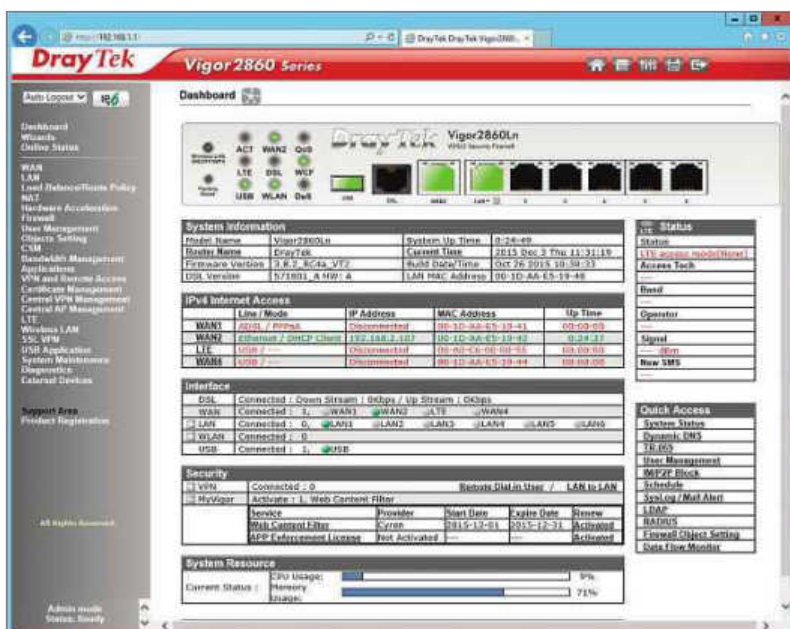
isn't the cheapest SMB router around, but you'll be hard-pushed to find this many security features elsewhere. Its VPN support is top-notch and DrayTek's PC Pro Excellence Award in 2015 seals the deal for a well-deserved Recommended award.

SPECIFICATIONS

Desktop chassis • 7x Gigabit Ethernet (6x LAN, 1x WAN2) • ADSL2+/VDSL2 interface • 4G LTE SIM slot • 2.4GHz 802.11n wireless • USB 2 • external power supply • 241 x 166 x 44mm (WDH) • 2yr RTB warranty • Options: USB thermometer/1m cable, £20; 1yr web filtering, £35 (all exc VAT)

"The Vigor 2860Ln isn't the cheapest SMB router, but you'll be hard-pushed to find this many security features elsewhere"

LEFT DrayTek's busy web interface clearly shows how many features the Vigor 2860Ln offers



Linksys LRT224

Performance is so-so, but Linksys offers the best business VPN options for the price

SCORE ★★★★★

PRICE £144 exc VAT from broadbandbuyer.com

The LRT224 from Linksys looks a top choice for small businesses that demand the best VPN features. Costing less than £150, this compact steel box can handle up to 50 site-to-site or client IPsec VPNs and augments these with support for PPTP, OpenVPN and Linksys' very own EasyLink VPN.

It has four Gigabit LAN ports and two more for WAN links, where it performs link failover or load balancing across them. Security features include a standard SPI firewall and DoS protection, along with support for custom access rules and simple website filtering.

The wizard-aided installation had the router up and running in less than five minutes. For WAN redundancy, you can choose from failover, load balancing or the new sticky load-balancing feature that sends identical TCP sessions through the same WAN interface.

Firewall access rules allow for blocking or permitting actions to sources, destinations and services. For the latter, you can add your own custom services. Web-content filtering isn't great, however: all you can do is apply blacklists of domains or URL keywords.

Bandwidth management features are more versatile: after entering upstream and downstream speeds for each WAN port, we could apply a minimum guaranteed bandwidth to specific services or IP addresses. QoS is also available, allowing you to choose a WAN port, protocol and direction, and assign high or low priorities.

The EasyLink VPN feature is designed to make light work of creating site-to-site IPsec VPNs, and setting one up involves just a few simple steps. However, it's only supported by Linksys LRT routers, meaning you'll need to use standard gateway IPsec VPNs for other models.

Linksys doesn't include any IPsec VPN client software, but it should be applauded for the extensive online help it provides for third-party products. There are clear tutorials with step-by-step instructions for the Shrew Soft Windows and IPSecuritas OS X clients.

The LRT224 supports a maximum of five OpenVPN tunnels, and as it runs the server component itself, we only needed to download the free Windows client. Another bonus is that the client uses predefined configuration files, so you won't

ABOVE The compact steel box has four Gigabit LAN ports and two more for WAN links



need to train users in the ways of VPNs either.

Server setup is well documented, meaning it took us only a couple of minutes to create an encrypted OpenVPN tunnel. Client configuration was easy, too, allowing us to add a username and password along with certificate details.

The smart part comes next, however, with the client connection details being exported as a file or email. Once the file is copied into the OpenVPN Program Data configuration folder, users just fire up the client, select the connect option and log in. Well, it would be easy, but Linksys forgot to mention one very important detail. The OpenVPN client must be run with elevated privileges or it fails to update the client's routing table and won't connect properly.

"After entering upstream and downstream speeds for each WAN port, we could apply a minimum bandwidth to specific services"

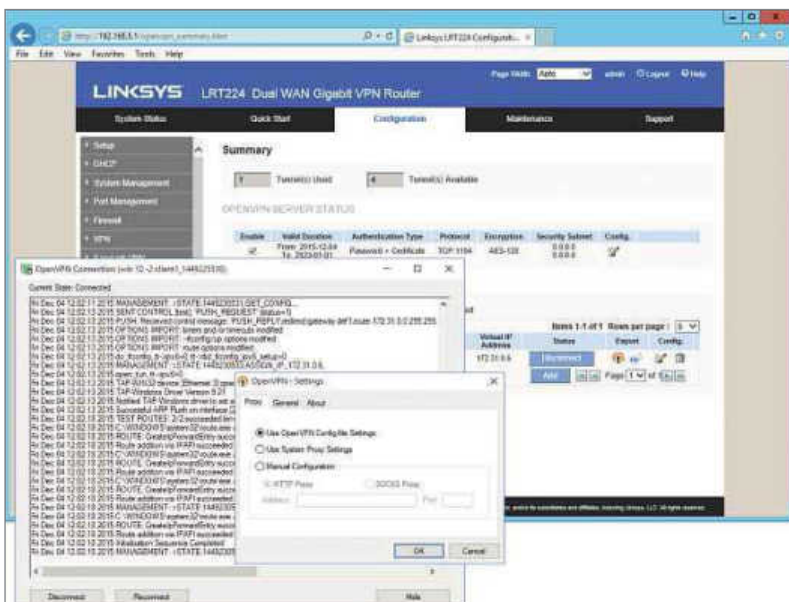
Performance is another issue since OpenVPN uses SSL, which is more demanding of the router hardware than IPsec. File copies between a remote Windows 10 desktop and a mapped drive on

a LAN-based server only returned an average throughput of 1.5MB/sec.

Moreover, PPTP VPNs are even easier to create but performance is equally unimpressive. Copying the same test files to the LAN over a Windows 10 PPTP VPN link mustered only 1.3MB/sec.

Overall performance is disappointing, but Linksys gets a pat on the back for its excellent VPN documentation and online help. Furthermore, the LRT224 is good value because no other router at this low price point can match its range of VPN services.

LEFT The LRT224 runs the OpenVPN server component for creating free SSL client VPNs



SPECIFICATIONS

Desktop chassis • 6 x Gigabit Ethernet (4 x LAN, 2 x WAN) • IPsec, PPTP, OpenVPN, EasyLink VPN • external power supply • 130 x 191 x 40mm (WDH) • limited lifetime warranty

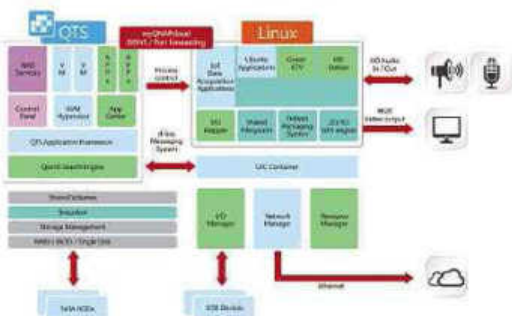
7 SECRET TALENTS OF QNAP'S LITTLE BLACK BOX

Heard the saying great things come in small packages? It could have been tailor-made for the QNAP TS-453A



1 Double power: Linux and QTS

This is truly two machines in one. There's QNAP's own advanced operating system, QTS 4.2, for advanced NAS features such as storage, backup and media streaming, but you can also run Linux. Plug a monitor into an HDMI port, along with a mouse and keyboard, and this little box turns into a fully fledged PC.



2 Double vision: dual 4K HDMI outputs

Just to show this is far more than a normal NAS, there are two HDMI ports to enjoy. They can show the same display if you like, but switch to extended mode and you could have one of the many QTS apps (Plex, Kodi, YouTube, Spotify) running on one screen and browse the web on another via the Chrome app. Or load up Linux and extend your desktop across both screens.



3 Smart virtualisation

Of course you can host VMs on the TS-453A. Of course you can access them via a browser or VNC. And yes, multiple OSes are supported, VMs are created quickly and you can take snapshots – all the features you'd expect. What's particularly clever, though, is its hybrid approach: uniquely, there's LXC for full OS virtualisation while Docker is tuned for applications. You can even run multiple, isolated Linux systems and download apps from the built-in Docker Hub Registry.

4 Create your own surveillance station

Want to use the TS-453A as the central tool in your surveillance setup? No problem. It supports over 3,000 IP cameras, has four free IP camera channels, and can work 24 hours a day, seven days per week. Moreover, you can download the Vmobile app on iOS or Android, so you can view and manage the monitored channels no matter where you are. Or even install the Vcam app to turn your mobile device into a network camera.

5 Hardware-accelerated encryption

If you store any sensitive information, anywhere, then you should encrypt it: if the worst happens, and a hacker finds a way into your network, it's a crucial layer of protection. The TS-453A not only includes all the security options you'd expect, but also hardware acceleration to ensure that keeping data secure doesn't slow you down.

6 4K H.264 transcoding

Like a welterweight fighter, there's a surprising amount of coiled-up power within the QNAP TS-453A, including eighth-generation Intel HD Graphics via the quad-core Intel Celeron N3150 processor. In fact, there's enough to transcode 4K video on the fly – that means this little box can smoothly convert and stream 4K video streams to your PC, laptop or Smart TV.



7 The ability to turn back time

Well, to an extent at least. If you accidentally delete files, then QTS Storage Manager is your friend: this web-based snapshot tool gives you the ability to revert back to a particular point in time. That means you can turn back time for a particular file, folder or everything on the NAS, which could also come in handy if files become corrupted.

To find out more, visit pcpro.link/257qnap

TP-Link SafeStream TL-ER6120

A high IPsec VPN count for the price, plenty of WAN failover features and good remote-access performance

SCORE ★★★★★

PRICE £144 exc VAT from ebuyer.com

Small businesses that demand secure access for their remote workforce may well find that TP-Link's SafeStream TL-ER6120 is just what they need. For a very modest price, it supports up to 100 IPsec VPNs and provides dual Gigabit WAN links for essential internet redundancy.

However, there's more to this 1U rack unit. Security features include service blocking, application controls and website filtering. You get three Gigabit LAN ports, with the third functioning as a DMZ for protecting public servers. It even has integral 4kV surge protection so it won't get fried by a lightning strike.

Installation took us five minutes, with the tidy web console providing easy access to all the features. WAN redundancy and failover features are abundant and creating a backup link took only two clicks, with which we designated the primary and backup ports.

Failover mode only swaps to the backup link if the primary one goes down, but a timing mode can use a daily schedule to switch between them. Bandwidth policies can be used to control traffic in a specific



direction and can enforce guaranteed minimum upstream and downstream bandwidths. Application-optimised routing ensures all packets with the same source and destination IP addresses are sent through the same WAN port. Once we had set our bandwidth limits for each WAN port, we could go on to employ balancing based purely on traffic loads.

TP-Link doesn't include any IPsec VPN client utilities and only provides a 30-day trial of the TheGreenBow client software. Single licences costs around £41, while a five-user pack will set you back about £194.

TP-Link provides detailed tutorials showing how to set the appliance up to use TheGreenBow. It's a tedious process that's easy to get wrong, but after a couple of attempts we had a working IPsec VPN between a remote Windows 10 desktop and the router.

We were unable to achieve the claimed throughput of 16.25MB/sec for 3DES IPsec VPNs in our tests, but the router performed much better than others in this price bracket. With a mapped share from a Windows Server 2012 R2 host on the LAN, we could copy a 700MB file to a Windows 10 desktop at an average speed of 10.9MB/sec, even with the router's web interface showing 100% CPU utilisation during the test.

We also tested PPTP VPNs and, although TP-Link's tutorial is dated,

ABOVE The TP-Link has three Gigabit LAN ports, with the third functioning as a DMZ for protecting public servers

"Security measures are good and the router's firewall protects against common flood attacks such as DoS"

BELOW Using TheGreenBow IPsec VPN client shows how the router struggles with encryption duties

we were able to get one working on Windows 10 without any problems. Performance was noticeably lower, with the same copy operation now averaging 4MB/sec and the router's web console failing to respond at all until it had finished.

General security measures are good and the router's firewall protects against common flood attacks such as DoS. You can set thresholds for each type in packets per second and prevent the WAN ports from being scanned. You can also decide which LAN users are allowed to have internet access by applying MAC

address filtering lists, although these must be created manually.

The firewall's URL-filtering feature is no different to that offered by most consumer routers, and it's of limited value

as it only uses simple lists of URL addresses and keywords. Access rules are more versatile – you can block or allow specific services and each policy can be run to a daily schedule.

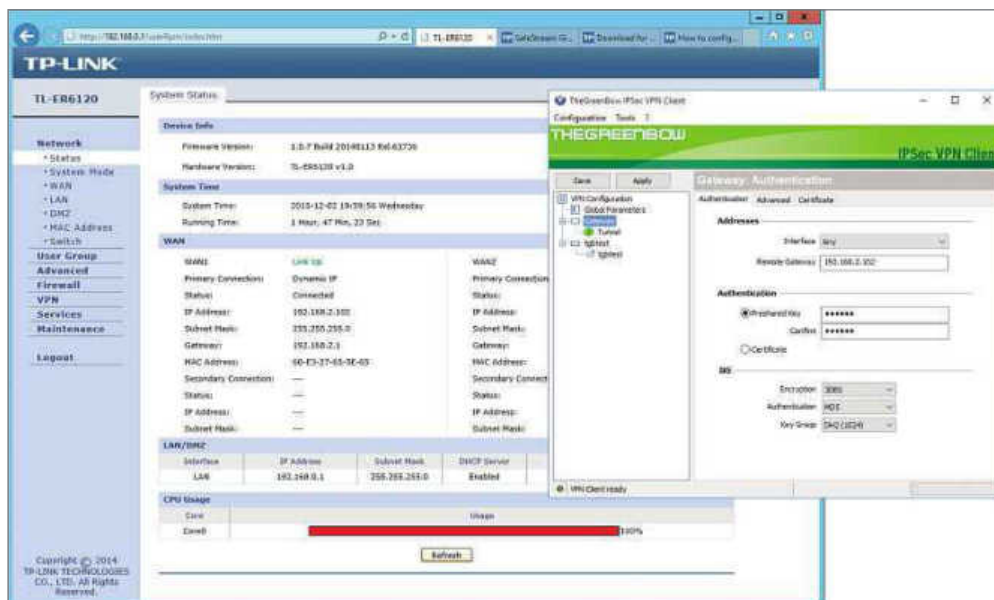
You can also use policies and schedules to block or permit peer-to-peer and messaging apps – the list of supported applications is short. Options are only provided for 25 common clients, including Skype, BitTorrent, Facebook and Twitter. However, you can't add custom apps yourself.

URL-filtering and app-control policies can also be applied to groups of users. This feature is only practical for a small userbase, though, since they can only be defined to the router by their system IP address.

TP-Link's TL-ER6120 may support 100 IPsec VPNs, but we wouldn't recommend using them all at once – the hardware will struggle. That said, it delivers superior performance to other small-business VPN routers and offers an extensive range of WAN failover features. **DAVE MITCHELL**

SPECIFICATIONS

1U rack chassis • 5 x Gigabit Ethernet (2 x LAN, 1 x LAN/DMZ, 2 x WAN) • RJ45 console • supports 100 IPsec VPNs • internal surge-protected power supply • 1yr RTB warranty • Options: five-user licence for TheGreenBow IPsec VPN client, £194 exc VAT





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EXCLUSIVE

Boston Fenway 2104-0C

A low-cost rack server with the latest Xeon E3 v5 CPU and frighteningly fast NVMe SSD storage

SCORE ★★★★★

PRICE £1,745 exc VAT from boston.co.uk

Boston's Fenway 2104-0C is a slimline 1U rack server packing Intel's latest Skylake Xeon E3 v5 CPU. Aimed squarely at small to medium-sized businesses, the 11-member Skylake family of server CPUs delivers a choice selection of new features, most notably a drop from 22nm to 14nm and support for 64GB of fast DDR4 memory.

The Fenway is built around the entry-level 3GHz E3-1220 v5, which has four cores, an 8MB L3 cache and a low 80W thermal design power (TDP). Support for Intel's Turbo Boost 2 lets it shift up to 3.5GHz in times of need, but Hyper-Threading is off the table.

This is an all-Supermicro package with the X11SSL-nF motherboard housed in a compact, 53cm-deep SC113 chassis. It may be short, but it stands tall in the features department, especially storage.

The chassis has eight hotplug small-form-factor (SFF) drive bays, in the last of which is a 400GB Intel MLC NVMe SSD. It's been neatly integrated into the chassis: the drive backplane has its pair of PCI Express 3 NVMe ports cabled directly to dedicated sockets on the motherboard.

The price also includes a quartet of 1TB Seagate SFF SATA hard disks. The C232 chipset supports RAID0, 1, 5 and 10 arrays, but Boston has sidestepped this and used Microsoft's Storage Spaces to provide a 2.7TB parity drive.

This means the Seagate drives provide a data-storage repository with room to expand, while the operating system lounges on an NVMe SSD – and boy, is that Intel SSD quick.

Running Iometer with a 4K transfer request size, we recorded read and write throughputs for the SATA parity drive of 20,000 and 2,300 IOPS respectively. Running the same test on the SSD delivered stunning rates of 192,000 and 130,000 IOPS.

Cracking open the Fenway reveals a tidy interior, with the CPU wearing a big passive heatsink and flanked by four DIMM slots. All six SATA ports are cabled to the backplane, so you have two spare drive bays ready for action.

The two orange SATA ports can also be used for disk-on-modules (DOMs) as they have dedicated 5V power sockets. At the rear are pairs of Gigabit, USB 3 and USB 2 connectors, while the 10/100 port above provides dedicated remote-management access

ABOVE The 2104-0C is compact, but it stands tall in the features department



"The Fenway is a power miser: in idle, we measured it sipping 53W and peaking at only 93W with the CPU under extreme load"

to the embedded Remote Management Module (RMM) chip.

The system has four dual-rotor cooling fans with room for two more, should you decide to use the single PCI Express expansion slot. Noise levels are noticeable, though, with the SPLnFFT iOS app measuring the server emitting an annoying 63dB.

The price includes dual 600W hotplug PSUs and we found the Fenway to be a power miser. With the system in idle, we measured it sipping 53W and peaking at only 93W with the CPU under extreme load from the SiSoft Sandra benchmarking app.

Its remote-management features won't threaten rivals such as HP and Dell, but the basic RMM web interface does provide sensor readouts for all key components, power consumption graphs and options to link thresholds with Single Network Management Protocol (SNMP) traps and email alerts. Usefully, you get full remote control and virtual media services as standard and not as optional extras.

Supermicro's SuperDoctor 5 SNMP management utility is bundled and,

as long as the server is running Windows, you can access it locally or remotely via a web browser. You'll be greeted by colourful graphs and speed dials for fans, temperatures and

voltages, plus an inventory view.

Boston has put together a super server for the price, with the Fenway 2104-0C packing plenty of features into its space-saving chassis. The Xeon E3 v5 CPU provides oodles of processing power; it has room to grow in the storage department; and that superfast NVMe SSD means never having to worry about OS performance again. **DAVE MITCHELL**

SPECIFICATIONS

1U rack chassis • Supermicro X11SSL-nF motherboard • 3GHz Intel Xeon E3-1220 v5 • 16GB ECC UDIMM DDR4 RAM (max 64GB) • 6 x SATA 3 • 2 x NVMe • 4 x 1TB Seagate Constellation SFF SATA • 400GB Intel P3500 NVMe SSD • supports RAID0, 1, 5, 10 • 8 x PCI-E slot • 2 x Gigabit Ethernet • RMM with 10/100 Ethernet • 2 x 600W hotplug PSUs • 3yr on-site NBD warranty • power: 53W idle; 93W peak

LEFT The web console provides useful power-monitoring tools for the server



Canon i-Sensys MF724Cdw

Not the cheapest or fastest, but Canon's new colour laser MFP delivers good quality and stiff access security

SCORE ★★★★★

PRICE £273 exc VAT from printerland.co.uk

If you're short on office space, Canon's i-Sensys MF724Cdw could be the printer you're looking for. This A4 colour laser multifunction device (MFD) has a reduced footprint, but still manages to pack in plenty of office-friendly features.

It offers print, scan and copy functions; nippy 20ppm colour and mono print speeds; an integral duplexer; and wired or wireless network support. Its 8.9cm LCD colour touchscreen makes light work of walk-up printing and copying, but it lacks NFC and phone-fax functions. If you need these, check out the Canon MF729Cx instead.

The 600ppi colour flatbed scanner on top of the device is partnered by a 50-page duplexing automatic document feeder (ADF), while the USB port at the front can be used to print from, or scan to, removable storage devices. AirPrint support, for iOS devices, is enabled out of the box.

To keep printing costs down, we'd recommend using Canon's twin pack of K toner cartridges. At only £15 more than a single K cartridge, this cuts per-page costs for mono and colour prints by a penny each to a more acceptable 1.5p and 11.3p respectively.

Installation using the LCD panel is a swift process, and allowed us to secure admin access using a PIN. It also ran a useful calibration process, which prints a colour page that it then examines using the scanner.

The printer's web console is clear and opens with a status view of the toner

cartridges and paper tray, along with a list of detected errors. From the Settings page, we could alter the deep sleep timer and set the printer to shut down after between one and eight hours of inactivity.

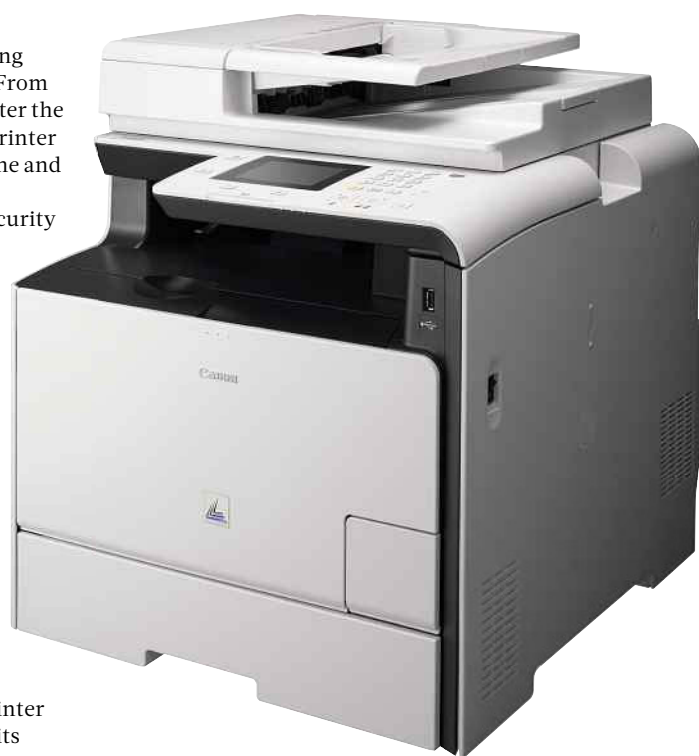
Canon has improved its security setup on this device, which supports LDAP and Active Directory authentication, and lets you enable or disable access to any or all of the USB ports. The driver's Secure Printing option, meanwhile, lets users assign a PIN to a print job, which will be held in the queue until the PIN is entered on the device control panel. This ensures that sensitive data won't be overseen by anyone loitering by the printer.

A Department ID feature forces users to log in to the printer before they can access any of its functions. We could restrict access to scanning and colour printing for any ID, although it wasn't possible to limit the number of pages produced.

These settings can also be enforced on desktops from their printer driver properties. We requested that the ID and PIN were confirmed for each print job and could stop unauthorised use by blocking jobs with unknown IDs.

We used the printer's internal address book to enter details of email addresses, network shares and FTP sites that can be accessed from the local control panel. Canon's scan utility lets users scan straight to their desktop and the bundle includes the Presto PageManager document-management software.

Cloud features are scarce as the MF724Cdw only supports Google Cloud Print. Registering the printer



ABOVE The Canon's 8.9cm LCD colour touchscreen makes light work of walk-up printing and copying

from the web console was a two-click process and we could print documents remotely from Google Chrome.

General print quality is impressive, with text at the smallest font sizes razor-sharp and showing no signs of dusting. Colour photos were vibrant, with only a hint of banding.

"The Secure Printing option lets users assign a PIN to a print job, which will be held in the queue until the PIN is entered on the panel"

Print speeds are variable, with a 20-page Word document delivered at precisely 20ppm and duplexed at 10ppm. Colour was more challenging: it couldn't muster more

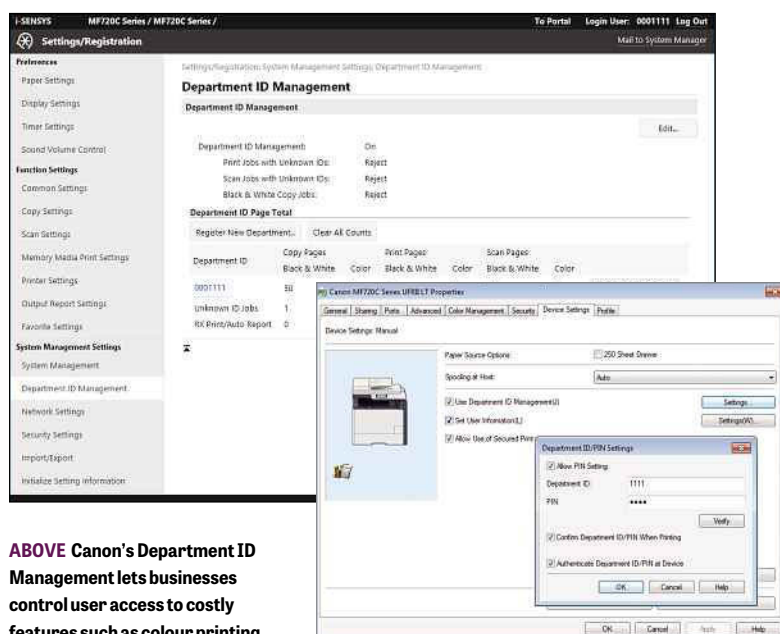
than 16ppm when working its way through our 24-page DTP print. However, the time to first page for all tests was never more than 17 seconds.

The scanner performed well, reproducing glossy magazine covers with sharp focus. Its ADF did good work, with a 15-page, mono, single-sided copy produced at an average of 16ppm and a 15-page duplex-to-duplex copy at speeds of 5ppm.

Canon's MF724Cdw is expensive, but it can't be faulted for output and scan quality. The improved security features also make it a good choice for businesses that want to keep usage under strict control. **DAVE MITCHELL**

SPECIFICATIONS

600dpi A4 colour laser • 20ppm colour/mono • 600dpi colour scanner • 1GB RAM • 10/100 Ethernet • 802.11n wireless • 3 x USB 2 • 250-sheet input tray • 50-sheet MPT • 50-sheet DADF • duplex • recommended monthly duty cycle, 2,000 pages • Canon MF Scan and Selector utilities, Presto PageManager 9.39 software • 430 x 484 x 479mm (WDH) • 31kg • 1yr on-site warranty • Options: 250-sheet cassette, £180 exc VAT



ABOVE Canon's Department ID Management lets businesses control user access to costly features such as colour printing



THE BUSINESS QUESTION

Does my business need an app?

Worried that you're being left behind by app-enabled rivals? **Nik Rawlinson** helps you consider whether you need an app, and the process you must work through before it goes live

Businesses are adopting apps eight times faster than they took to the web, even when the dotcom fever was at its height. Seemingly everyone who's anyone wants to bag themselves a home on your tablet or phone, but should your business be among them?

To answer this question properly, you need to understand the role an app can play – and what you want your implementation to do. The latter falls into three camps: generating revenue, increasing brand awareness or saving your company money by ironing out kinks in its workflow.

While the first two of those aims are satisfied by consumer apps sold through a store, the third is most often a closed system for in-house use. Pete Gatenby, senior enterprise consultant

at B6o Apps (b6oapps.co.uk), one of the UK's 100+ app-development houses, identified what he calls "soldier" and "hero" apps.

"[For soldier apps], we use the analogy of an archer who's only there to do one thing – fire arrows, nothing else. But hero applications are often a lot bigger and can do many things. For example, one where employees can do all of their HR tasks on the go, whether they're a salesperson on the road or an accountant in the office: an app through which they can do things like use the internal intranet, book holidays, submit expenses and so on."

However, there's no reason why it needs to be so clear-cut, as explained by Jonathan Boakes, UK managing director of app-development firm Nodes (nodesagency.com): "When

[Dutch transport company] Abellio took on the ScotRail franchise, it wanted to give passengers ownership of the stations by allowing them to take a photo of damage or graffiti and get a message back from Abellio to say that they're working on it. [When the job had been done] the customer would get another message saying it's all fixed and we hope they enjoy their journey." Why? "It's a marketing thing that gives people a warm, fuzzy feeling: you think, 'even if my ticket prices have just gone up by a pound, I do feel that they care about me a little more than they did before'."

Nodes developed the app, but rather than creating two entities, one customer-facing and one internal, it used a single codebase to produce a tool that presented Abellio staff with a different view – effectively a list of jobs and an internal leaderboard – if they logged in with company credentials.

"Implementations fall into three camps: generating revenue, increasing brand awareness or ironing out kinks in your workflow"

■ How to pitch your own app

Clearly, Abellio's app only works for that kind of company, so how do you commission an agency

to develop something specific to your own needs? The key is to take your time. Decide internally what you need and what you want before you approach an agency.

Jason Gaved, managing director of Lexel (lexel.co.uk), frequently receives enquiries from potential

customers who have yet to think through what they're looking for.

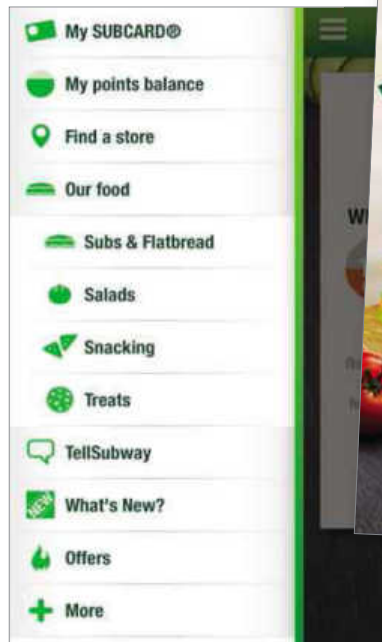
"The best approaches are where people have come up with a statement of what they want to achieve, some features of the app and basic wireframes. It gives us a very clear indication of what they're looking to do, even if it isn't correct. That way they get the most accurate estimate."

Boakes agreed: "We'd rather someone came to us knowing exactly what they want so we can get straight in and start building it. A lot of the time when we build an app we also try to build an internal capability for them [to take it forward after it's been launched], because it's not in our interest to try and hog work. We want people to have a good mobile experience and then want to do more mobile work."

When the app is out in the wild, it must be nurtured: responding to customer queries, heading off complaints by considering feedback (and building in feedback tools to the app itself, if possible) and bug-fixing over time. This is how apps achieve five-star reviews, after all. Many agencies work on a service-level agreement to provide this, taking a percentage of the cost of the project for continued support, but Nodes doesn't feel this is always the best solution.

"We moved away from that a while ago, and now have what we call a service-agreement timebox," Boakes explained. "There aren't going to be any new [mobile] screen sizes or operating systems any time soon, so why should the client have to pay for [updates to cater for them]?"

Instead, companies pay for a certain amount of support per quarter, but if it isn't used then the time is rolled over to the next quarter.



This helps to ease fears about high running costs, which is one of the barriers known to stop companies from investing in apps.

Do you need an app?

However, the question is whether your organisation needs an app of its own at all. We asked each of our contributors whether we're at the same point now as we were when the world shifted from paper-based forms and phoning up from adverts to doing all of our business, online. The consensus was that either we are, or we've already passed it. However, despite app developers having a vested interest in encouraging us to shell out for development time, they advised against working on a mobile tool that wouldn't deliver a return – awareness, revenue or cost savings – for the client.



ABOVE Subway's app both increases brand awareness and offers something back to the customers, namely the Subcard loyalty system

"I'm in two minds as to whether a mobile app is required in the same way that a mobile website is," said B60 Apps' Pete Gatenby. "An app is a permanent point of reference to a brand on your device, so users want to see a return – something of benefit to them, or having fun with an app."

Gatenby cited Subway and Zipcar as two prime examples where apps not only increase brand awareness, but offered something back, in the form of loyalty points (Subway) or easy interaction with a company's back-end

systems and mobile assets (Zipcar).

"If you look at the younger generation, we're going to see a complete culture change and a shift towards apps," said Lexel's Gaved. "People don't want to talk to people now. If [as a customer] you can do something through an app you can do it when you want, when it's

convenient for you rather than sitting on a phone line for 20 minutes."

Nodes' Boakes feels much the same way: "I think we're in a time where companies feel they should be

engaging in mobile. We're in an experimental phase. Clients often ask what's the right way to do things, but there is no right way – it depends on your business and your customers. We're moving to a time where people will expect some kind of mobile relationship with businesses." ●

"Clients often ask what's the right way to do things, but there is no right way – it depends on your business and your customers"



The expert view Paul Ockenden

The iPad sitting here on my desk has just shy of a hundred apps installed, yet if I think back over the past month, I've used perhaps six of them. This isn't unusual – most people find that their phones and tablets quickly become a graveyard of unused apps, and the last thing you want is for your company's app to join them there.

If your business app is simply a static brochure, you've probably wasted your money. Your budget would have been better spent on making your website mobile-friendly. Apps should actually do something, and that usually means providing a service or some kind of entertainment. Without this, you've got one foot in the grave before you've even started.

In these days of ubiquitous connectivity, you don't need to worry about building too much content into the app itself, because it can all be pulled in as required using feeds and web services. The app simply becomes a framework, holding these bits of content together.

People often discuss whether an app or a mobile website is best. To some extent, the distinction between the two is becoming quite blurred. Although certain apps are driven by pure native code, many (especially corporate apps) use technologies such as Apache Cordova (previously known as PhoneGap) to build native-looking apps using HTML, CSS and JavaScript – it's just like creating a website, and uses the same tools and techniques. Some apps go further still and are effectively just a frame onto a mobile website.

However, that's not a great idea if you want to offer your app publicly, as Apple's App Store guidelines state: "Apps that are simply web clippings, content aggregators, or a collection of links, may be rejected", and it's not kidding – many apps seem to be turned down for this. In fact, there's a huge list of reasons why your app might be rejected (pcpro.link/258apps). Many people stumble across this list right at the end of their app-development process, but you really must read and digest it on day one. It will save headaches and heartache further down the line.

If you abide by the rules, and design an app that users will find genuinely useful or entertaining, you may well have a hit on your hands. Always keep the app graveyard in the back of your mind.

Threat intelligence

Properly understanding the threats to your business will help you defend against them, explains **Davey Winder**



■ Threat intelligence? What does that actually mean?

Good question, and one that can be answered by explaining what it isn't: threat intelligence is not information about threats. Say what? Yep, you heard that right, information is not intelligence. There's far too much raw information already, and gathering more of it willy-nilly would be dumb. Unfiltered, non-analysed security information from any and every source does not threat intelligence make.

■ Okay, so what is "threat intelligence"?

Data from your firewall or unified-threat-management (UTM) device, information on attacks on peer companies and vertical market vulnerability trends can all strengthen your security. However, this is only possible by collating and correlating it so as to provide actionable advice. Information must be aggregated from only reliable sources, filtered, analysed, put into context and then delivered in a timely, understandable format in order to become usable intelligence. Contextual analysis is the priority, as without this the identification of real threats is all but impossible.

■ What kind of real threats are we talking about?

To give just one example, a threat intelligence service can draw on data from millions of endpoints, which is then contextually analysed to reveal genuine threats and compromises, and how to deal with them. Having sight of such threat feeds allows in-house security teams to better understand, and therefore more efficiently defend against, threats that are likely to impact upon your organisation.

■ Why should it worry me? I'm not the military or the government.

Threat intelligence isn't something out of a Bond movie; delivered properly it can make any business more secure. The ultimate point of any threat-intelligence system is to deliver actionable information that can support your security decision-making process. Generic alerts can become timely, business-specific ones, complete with meaningful severity ratings. Emerging threats that could impact your organisation, industry or bottom line can be spotted and your security strategy (and investment) adjusted to address them.

Threat intelligence helps you make better decisions when it comes to prioritising resources and responses.

■ This sounds expensive. Can't I provide my own intelligence feeds?

You can and, according to IDC's newly published "Towards Threat Wisdom" study, that's precisely what 58% of firms are doing. The research suggests the majority are buying off-the-shelf threat-intelligence products and managing these themselves rather than outsourcing to a third party. Again, the problem here is information versus intelligence; security operations are often overwhelmed by the data provided, and without proper contextual awareness it's hard to get a meaningful picture of the threat landscape. Managed security services are on the up, courtesy of the cloud, and there's no reason why Threat Intelligence as a Service shouldn't be on your radar.

■ Do I need any specialist hardware?

You should already have some kind of intrusion-detection system (IDS) and intrusion-prevention system (IPS) in place, and most of these are capable of feeding the kind of raw information

"Threat intelligence is about enabling you to make better decisions when it comes to prioritising resources"

a managed service can use. Of course, it will also collate relevant external threat data, indicators of compromise and the like. A threat-intelligence service can then feed the resulting "intelligence" back into your systems in a standardised format, and provide industry- or organisation-level customised threat reporting.

■ Will it solve all my security problems?

No. Truth be told, you already need to be doing security pretty well before threat intelligence can be of much use. That means already having a working and mature security strategy covering such things as patch management, event logging, malware detection, network monitoring, incident response and investigation capabilities. Threat intelligence can then add even more strength to your security posture, but it isn't some kind of magic bullet that will secure a poorly defended business.

■ So how do I persuade the board?

Monitoring everything that's happening across the business is increasingly difficult, as the threatscape expands to include social media,

mobile, Bring Your Own Device and so on. The costs involved with analysing the volumes of data produced outside the perimeter are, frankly, prohibitive. In-house security teams will struggle to spot the real threats to the business, even with automated tools to help. The use of proper threat intelligence can help lower your risk profile by turning the "noise" of raw data into practical help. Threats evolve quickly, and having a continuous risk-monitoring capability will take you further along the path of mitigating them. ●

Jargon buster

IDS An intrusion-detection system monitors networks for policy violations including malicious activity

IPS An intrusion-prevention system acts to prevent those policy violations in the first place

Unified Threat Management A UTM appliance is an all-in-one device for network protection

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Essential admin tools for SMBs

Andrew Bettany pulls together the leading administration software so you can make the most effective choice for your business

The vast majority of small and medium-sized businesses (SMBs) will only deploy a reasonably small selection of software. IT administrators and IT support organisations, on the other hand, cannot afford to be so parsimonious. They will need a wide portfolio of tools and utilities if they're going to effectively support their customers, whether they're located in the same building or at the other end of an internet connection. Due to the IT resource constraints common to many SMBs – namely budget and staff – system admins often need to be more reliant on built-in, free or low-cost tools.

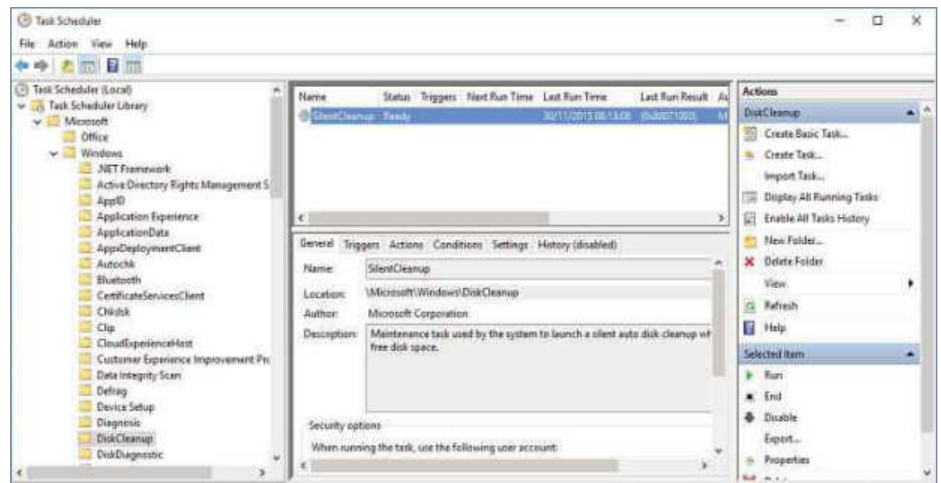
It's impossible to recommend a single set of utilities that will cover all eventualities. Moreover, if you asked a dozen admins to name their favourite, must-have admin tool, you'd almost certainly get a dozen different answers. That's not particularly helpful, which is why, over the next three pages, we've pulled together what we consider to be the leading options, so that you can make the most effective choice for your organisation.

They vary widely in both features and price, but we wouldn't want to be without any of them when keeping our own systems in prime condition.

■ Task Scheduler (built-in)

Despite Microsoft offering a selection of tools and utilities for system management and housekeeping, very few micro or small businesses would expect their users to maintain their own IT systems. Fortunately, however, if the client system is running Windows 7 or later, that's rarely an issue – much of the maintenance work is carried out automatically by the operating system. Routine tasks such as disk defragmentation, disk clean-up, Windows Update spin up automatically, and a quick peep at Task Scheduler will reveal dozens of built-in maintenance settings.

For some small and medium-sized businesses, relying on built-in tools will be sufficient, but most will soon outgrow them, in terms of both scope and functionality. Should you find yourself running up against Task Scheduler's limitations, it's the right time to move onto something more powerful.



ABOVE Most small and medium-sized businesses will soon outgrow Task Scheduler

■ Spiceworks Network Monitor spiceworks.com/app

The team at Spiceworks provides many tools, the majority of which are free and vendor-independent, and its Network Monitor is one of our favourites. It's a simple but effective tool that detects and scans every device on your network and provides a well-designed monitoring dashboard. This is customisable, too, so you can add your favourite information directly onto the portal.

The tool is free, meaning that it's supported by ads. You will see the occasional targeted advert, but these aren't intrusive.

Spiceworks continually updates its software to offer new features. In version 5, you could view the device inventory and had the ability to see the device warranty information based on asset tag information from the device (currently limited to Dell, HP and Lenovo machines). In the current version (6.1), this has been enhanced to allow you to request a warranty-renewal quotation for each device from within the tool. When you register for an account with Spiceworks, take a look at its forums and other resources. Spiceworks has a loyal following, and, consequently, the community forum is full of IT professionals who are keen to share knowledge.

■ Microsoft Baseline Security Analyzer

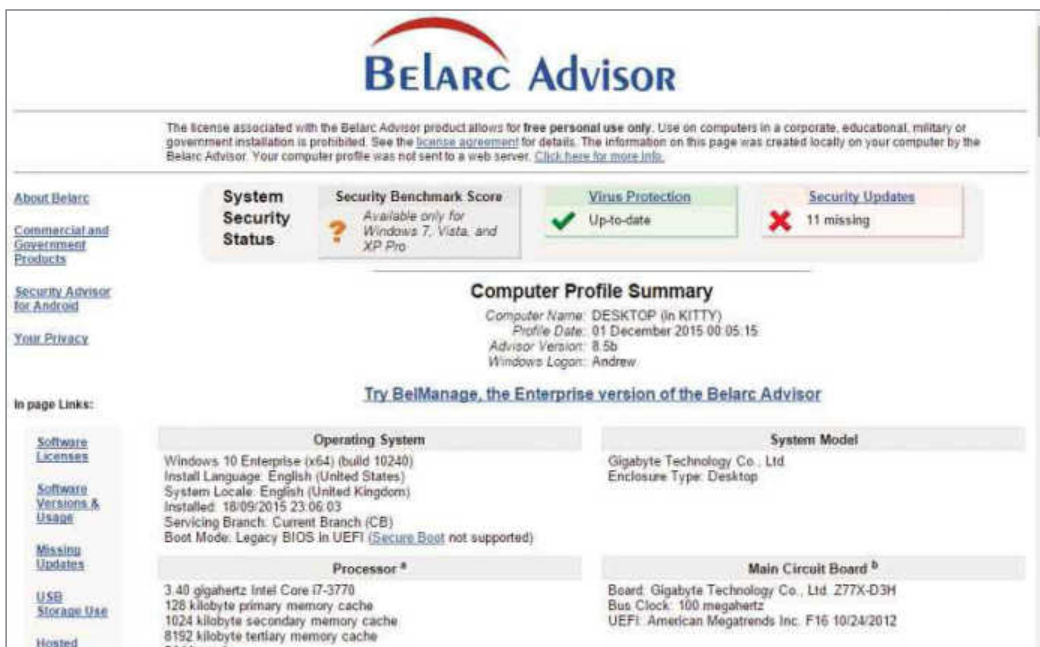
pcpro.link/258baseline

When testing a new system, running Microsoft Baseline Security Analyzer (MSBA) will reassure you that you're not dealing with a setup full of vulnerabilities, such as missing security updates and common security misconfigurations, including weak or absent passwords. If you have several PCs to review, MBSA can analyse every computer within a subnet or IP address range – a considerable time-saver when compared to doing the same thing piecemeal.

MBSA has been around for many years, and is still one of our favourite tools. It's recently been updated to support Windows



ABOVE MBSA will analyse a new system you're testing, and can even do several computers at once



LEFT Belarc Advisor provides support for Windows 10 and can even display the servicing branch in use

8.1 (not Windows RT) and later, although it will surprisingly still work on Windows XP and Windows Server 2003 – in several languages. Another neat feature is the option to use the free Microsoft Office Visio 2007 Connector for MBSA and then view the results of your scan on a Visio network diagram.

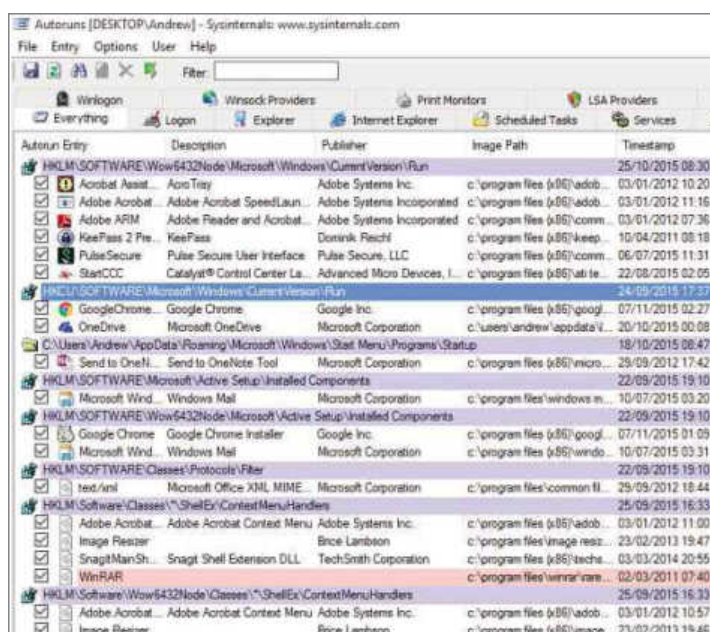
■ Belarc Advisor

When we're looking for information, we can't ignore the wealth of device-specific results returned by another old favourite: Belarc Advisor. Within a couple of minutes, the tool will analyse the machine and the local network, providing a detailed device, software and security report in a neat HTML format.

We've frequently used the tool to provide quick details of installed memory modules, motherboard type and revision, hard-drive capacity and remaining free space, CPU and GPU information and all installed software.

Support is now included for Windows 10, and the advisor tool will even display the correct servicing branch in use. Belarc's ability to find and report installed software licence keys is a highlight, and has saved us hours that would otherwise be spent searching for licence stickers on old retail boxes. Before any rebuild or upgrade of a PC, we recommend exporting a copy of the Belarc Advisor report so that you have all the software keys you may need later.

Belarc offers commercial licences for the advisor tool and many other tools that can be used to ensure software-licence compliance,



ABOVE Sysinternals' simple Autoruns utility allows you to view, disable, export and delete each entry

and to conduct security assessments and manage assets.

■ Sysinternals

Whenever we need to diagnose a problem, we head to Microsoft's Sysinternals site, which hosts a large selection of utilities for poking around under the hood in Windows. Originally authored by two developers, Bryce Cogswell and Mark Russinovich, and then acquired by Microsoft, it features close to 70 utilities, which are now available as part of the Sysinternals Suite. Autoruns (updated in October 2015 to include Office add-ins), Process Monitor and Process Explorer are by far both the most useful and popular.

For example, Task Explorer on Windows 8 and later has a Startup tab that lists the programs Windows executes on startup. On a busy system, the list can run to dozens of items, but fire up the Autoruns utility on the same machine and the list will expand to display many more entries.

On our test system, the ratio was 12:126, which is 12 entries on the Startup tab and 126 entries on the Everything tab in Autoruns (admittedly, 48 of these were driver-related entries). With this simple tool, you can disable, export, delete and view extensive information about each entry, which is particularly useful when you're trying to diagnose a misbehaving system. Use the online search for more information about a particular item.

Process Explorer and Process Monitor, meanwhile, provide a similarly in-depth look at processes and registry entries. This makes troubleshooting much simpler, as you can review actual changes that are taking place "live" on the test system. Use the powerful filters to focus on specific actions, such as identifying areas in the registry that are being modified during software installation or when performing configuration actions within Windows.

Don't overlook the related Windows Sysinternals Administrator's Reference book, as it provides in-depth information for IT professionals.

Russinovich's other books are also excellent – in particular the two volumes of Windows Internals.

■ Bomgar Enterprise Remote Support

If you're supporting dozens of users or organisations, you need a reliable method of doing so remotely from your helpdesk. Most SMBs will use Remote Desktop Connection, particularly for internal use. We prefer Bomgar, which we came across several years ago when working on a project that required not only remote desktop connections, but also that sessions be fully secured (Bomgar has FIPS 140-2 validation, and uses 256-bit AES SSL), while also allowing the support team to reconnect to any session across all clients.

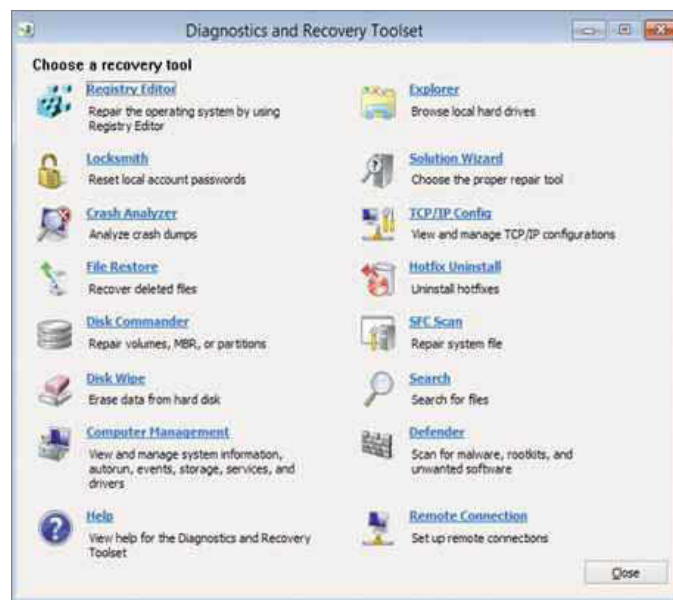
Bomgar's innovative solution allowed each session to be recorded (keystrokes, mice and a complete video of the screen), which provided reassurance and auditability of the interactions. This was invaluable on many occasions, especially when disputed actions occurred during a support call, and it also allowed the recordings to be used as an internal teaching resource for the team.

Bomgar eases any worry you may have about password or identity theft within the support organisation. All of the remote support is channelled through Bomgar itself, which connects directly to the remote client, meaning the helpdesk never needs to handle a customer's Windows password. This is especially useful when you're supporting external customers and their data security is in your hands. Even your trusted employees are a potential security risk, but because Bomgar doesn't expose security credentials to the support staff, you can be reassured that, even if you lose a member of staff to a competitor, you won't be losing the customer too.

PowerShell

Much has been written about PowerShell so it's likely that you're already using this essential administrators' tool, which is built into all modern versions of Windows. As the size of your estate grows and the number of devices and users grows with it, you'll need to use PowerShell to remain competitive and productive. Indeed, there are many tasks (especially with Office 365, Azure and others) that you simply can't achieve without it.

You don't need to learn everything at once, either: instead, you can start with the basics and then leverage scripts from others who have already mastered it. Your skills will improve with use, and you'll soon appreciate the speed at which you can accomplish and automate everyday tasks. There are many resources available to help you learn PowerShell, and we can recommend Don



ABOVE DaRT comprises a registry editor, deleted file restore, disk wipe and more

Jones' book *Learn Windows PowerShell in a Month of Lunches*, which breaks it all down into bite-sized parts.

Hiren's BootCD

pcpro.link/258hiren

If you're running Windows 10, you already have a very powerful recovery mechanism built into the OS in the form of Windows Recovery Environment (Windows RE). However, Windows RE only goes as far as repairing common Windows problems and startup issues. Hiren's BootCD system-rescue disc offers an alternative but more comprehensive "all-in-one" bootable CD or USB drive with dozens of utilities to help you diagnose and repair problems on troublesome devices.

All of the software is freeware or open-source, although some of the tools are from the Windows XP era. The authors have

gathered together more than 600MB of utilities to provide a "Swiss Army knife" tool that should allow you to boot and scan a system for viruses, test hardware, fix partitions, recover deleted files, repair your system files and much more.

Windows Defender Offline

pcpro.link/258defender
Most malware succeeds by attacking your most vulnerable employees. These users are often fooled into opening email attachments from

unknown recipients, while others succumb to malware that infects a thumbdrive or a rootkit that installs itself and becomes entirely hidden from Windows.

Windows Defender is regularly updated by Windows Update and built into Windows to offer real-time protection by scanning everything that you download or run on your PC. However, if you're infected by a zero-day vulnerability or a rootkit, you'll need to use an offline malware-removal tool. This is where Windows Defender Offline can help: it lets you boot your computer using a standalone app, which runs in a clean operating environment before the malware can take effect.

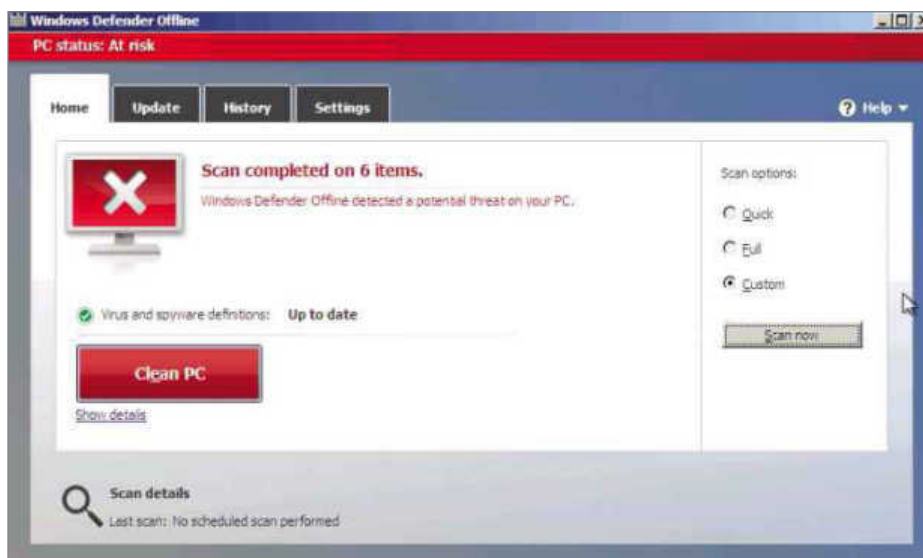
The Defender tool inspects your system, including the areas where rootkits reside to see whether the hard disk's operating system, programs and data have been compromised. If malware is found, the offline app will remove it.

DaRT

pcpro.link/258dart

If your organisation is a Microsoft Software Assurance customer, you'll be licensed to use the suite of tools contained in the Microsoft Desktop Optimization Pack (MDOP), which includes a comprehensive set of utilities called Diagnostics and Recovery Toolset (DaRT). This comprises a registry editor, deleted file restore and disk wipe, and more. Our personal favourite is the Locksmith Wizard, which allows you to reset or change any local account password on a Windows system.

Windows is becoming more reliable and contains many built-in tools to help you administrate and maintain systems. That means most of the problems we need to troubleshoot these days are hardware-related. However, we still carry a bootable 64GB USB thumbdrive with us at all times, containing a selection of the tools that were mentioned in this article. The drive also acts as both a recovery drive and storage media. ●



ABOVE Windows Defender offers real-time protection by scanning everything you download or run on your PC



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JON HONEYBALL

“After a fifth hard reboot, it decided to wake up into the setup screen and perform the install”

Given that the Surface Book, with its gorgeous hinge mechanism, is the flagship of the Microsoft Surface line, I felt I had to seek one out

My iPad Pro is still used on a daily basis and I am writing this very column on it, in between sessions and meetings at this year's Consumer Electronics Show (CES). I'm getting on fine with its clip-on keyboard and finding the key action to be good. Much of that is down to the firm base click and the slight roughness to the key tops. The biggest problem is juggling the multi-bending sections of the keyboard when you try to put it into the working position, which can feel like wrestling with an octopus. I just wish there were a better set of applications ready for it today, ones that really took advantage of both its performance and flexibility. Hopefully they will come soon.

However, the iPad Pro is not without competition. There's also much to like about the fourth-generation Microsoft Surface Pro, although it seems that the company has been experiencing something of a difficult birth with regard to drivers and overall system stability. Mine have been okay so far, but others appear to have legitimate concerns here. Some folk are also claiming that the Surface Book has real problems with going into and out of sleep mode (something, as mentioned below, that made my Dell XPS 13s wobble badly until they'd

had their BIOS firmware thoroughly reflashed). Clearly, I'm a glutton for punishment, because I'm currently in Las Vegas – where CES takes place – and the Surface Book was the one specific piece of hardware that I most wanted to get my hands on.

Surface Book was launched at the end of last year, but only in the USA – it should be on sale in the UK by the time you read this, some months after the US launch. Given that this is the flagship of the Microsoft Surface line, with a gorgeous hinge mechanism and a proper keyboard, I felt I had to seek one out, so I trundled over to Best Buy and found that they had them in stock. In usual Honeyball fashion, I decided I needed the fully stuffed model with an i7 processor, 16GB of RAM and 256GB of storage. I probably should have gulped at the bill for a few dollars short of three thousand (yes, you read that right... \$3,000), but it



Jon is the MD of an IT consultancy that specialises in testing and deploying hardware
[@jonhoneyball](#)

BELOW I splashed out \$3,000 for the fully stuffed Surface Book with 16GB of RAM

was new, it was shiny and it was going to be “The Very Best Laptop Money Could Buy” for Windows 10. Back at my hotel room, I unpacked it and started to set it up. Then things started to go wrong.

Instead of getting the proper setup process, I kept landing back at the login screen, even though I hadn't created any logins yet. Worse still, I couldn't log in to the Microsoft Intertubes using my existing account because its Wi-Fi could find no base stations. That's right, none at all – in a hotel that positively hums with Wi-Fi signals. Obviously, something was amiss, so I tried a hard reboot. Same issue. Another hard reboot. Same. Another. Same. After the fifth hard reboot, it decided to wake up into the setup screen and perform the install.

At this point, I figured my worries were over, but oh no, that would be too simple. In the setup routine, you're asked to join a Wi-Fi network, so I chose the hotel's Wi-Fi network, which – as is universal nowadays – presents a splash screen that tempts you to use its restaurants, pool and other amenities. However, the Microsoft setup process could not seemingly cope with this pop-up window, meaning I couldn't connect to the internet and had to choose “Skip this step” and come back later. Finally, my new Surface Book was up and running, but clearly in need of updates. A raft of them came down, including a set of firmware updates, but then the biggy arrived – the late-2015 update roll-up package. That's exactly what you don't want to see while on hotel Wi-Fi during CES week. It's currently at 78%. I may be some time.





Jon Honeyball
Opinion on Windows, Apple and everything in between – [p110](#)



Paul Ockenden
Unique insight into mobile and wireless tech – [p113](#)



Sam Marshall
Problem-solving using Office 365 – [p116](#)



Davey Winder
Keeping small businesses safe since 1997 – [p118](#)



Steve Cassidy
The wider vision on cloud and infrastructure – [p120](#)

My first impressions: it's an interesting design with lots of clever touches, but I can't shake the feeling that, while that hinge design looked great on paper, its engineers decided it was too hard to make it work tightly enough. The screen doesn't quite sit properly on the keyboard part, leaving a gap. Furthermore, the keyboard backlight coverage is patchy, which is disappointing. Of more concern is the complete lack of ports on the screen/tablet component. Once you detach the screen from the keyboard unit and go into a meeting, you have no more hardware connectivity than you'd have with an iPad, which could be limiting. Yes, I know you can drive decent projectors directly over IP nowadays, and that USB sticks aren't to be used in serious business environments. But shift the thinking to, say, a university student for whom their Surface Book might be their do-all-do-everything device, and this lack of onscreen connectivity becomes an issue. A USB Type-C port wouldn't have hurt, would it?

I hope to get to like this device, which is after all the reference design product from Microsoft itself and should, therefore, be the best of the best. However, my experience with the setup process so far shows that Microsoft has much more work to do in testing. Hopefully, the Europe-bound products will be better prepared, and will come with an appropriately patched OS and firmware already in place. I'll be very disappointed if they don't.

Password managers

I've moved over from 1Password to Dashlane. Without question, a password manager is the security tool of choice today, arguably one of the few must-fit tools on any device that I use (the other being Dropbox Business). Why the move? Well, Dashlane simply does a better job of form-filling, of suggesting and implementing strong passwords as a matter of course, and of being a better internet companion and looking after me.

However, it's not without flaws – the plugin for Chrome can consume eye-watering amounts of memory at times, and is tight-fisted about giving



that memory back, even when you shut down Chrome itself. Whether this is a Chrome issue or a Dashlane one isn't clear at the moment, but probably half and half I'd guess. It really does need fixing, though. We simply don't reboot computers these days with the frequency that we used to have to, meaning it's entirely possible to go for days, even weeks, without a restart. And it's not unknown for me to end up with 80 or even 100 web browser tabs on the go as well...

Dell screw-up, part two

How to put this politely? Last month, I detailed the staggering screw-up by Dell over the inclusion of root certificates in its management tools. I'm still aghast at what it did, but unfortunately things have taken a turn for the worse since then. I can say all of this with utter confidence because I bought two new XPS 13s a couple of months ago with my own money at full retail price. They're fitted with the latest Skylake chipset from Intel, and even appear to have a USB Type-C-compliant Thunderbolt port. Regular readers will know of my much-professed love for Thunderbolt, which I've used day-in, day-out for years running over fibre-optic cables in the lab, connecting my main workstation to a bunch of mission-critical storage devices, including Promise RAID arrays and a 50TB HP LTO-6 tape library. Those people who like to put down Thunderbolt simply don't know what they're talking about.

So I started to put these XPS 13s to real work in the lab and, of course, the first order of business was to clear

ABOVE Dashlane does a better job of suggesting strong passwords than 1Password

"It turns out that the Dell Update program is barely worthy of the name"

up the certificates mess. Fortunately, help was at hand when Dell released a software update that nuked the problem at source, and even Microsoft weighed into the action by adding the offending code to its malware list for Defender. At this point, I felt the matter had been resolved, and I now had two very high-class laptops whose hardware design and build clearly matched anything that Apple is currently shipping – and I had them both running Windows 10. Then the patches arrived.

First off, I should point out that Dell has an Update application that checks whether all the various bits, pieces, drivers and so forth are up to date, so I ran this tool and decided to set it to run in automatic mode. All the better, so I thought, to clear up any future messes as quickly as possible. How wrong I was. It turns out that the Dell Update program is barely worthy of the name: it checks for certain things, but doesn't check for others. For example, I discovered there was new UEFI BIOS firmware for the XPS 13 on Dell's website, and yet the Update program didn't say it was available. A bunch of other device driver updates were also available, but Dell Update was still mute on the matter.

I raised this with Dell, both through Twitter and via their UK PR firm, and they came back to inform me that Dell Update was actually only there to provide "critical updates", which makes it about as useful as a chocolate teapot. Who decides what is "critical"? Clearly Dell had decided that important just-post-release driver updates weren't "critical", despite their machines displaying a

range of unpleasant instabilities, including crashing on recovery from power-save mode and losing its entire Wi-Fi stack (drivers and all) when resuming from sleep mode. Let me be crystal clear – when a manufacturer’s utility says my computer is “up to date”, it really better be. If there are some “optional” upgrades, or things that need be patched only if specific problems have been encountered, mark them as such. But claiming that my machine is up to date while there are uninstalled updates waiting on the manufacturer’s website is otherwise called “lying”.

However, it was the BIOS firmware that blew my mind. I downloaded the BIOS firmware, and ran it. It’s a Windows application, as you might expect. It runs, asks for elevated permissions, and then rewrites the firmware. A quick reboot, and everything is up to date.

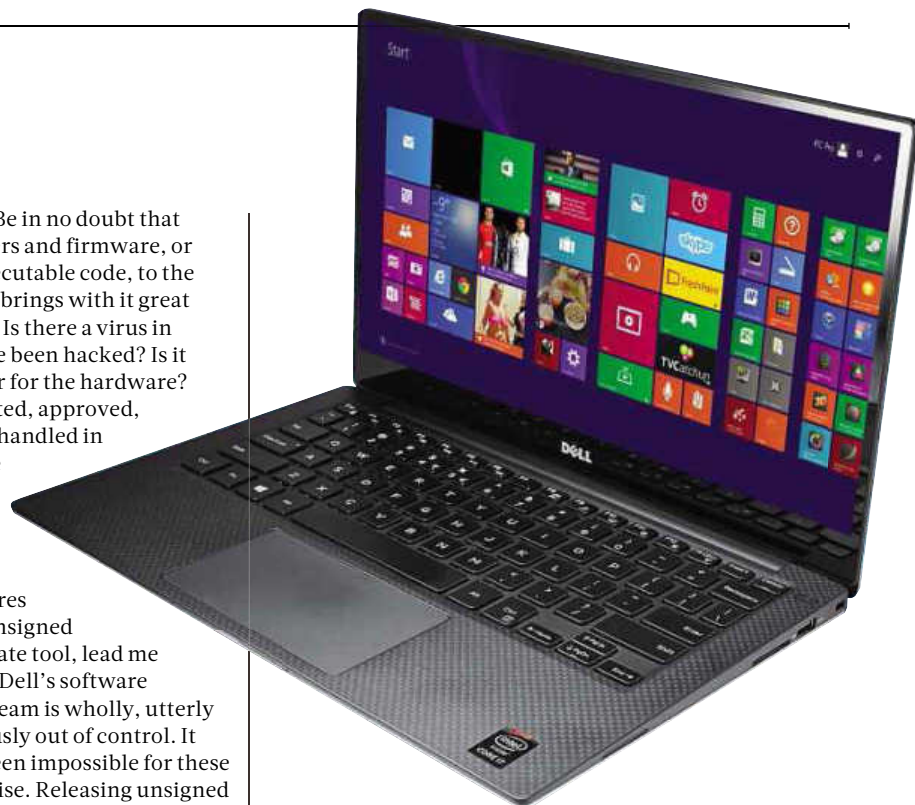
Moreover, when I ran the firmware updater, I couldn’t believe my eyes. There was no digital signature on it. The updater was asking for elevated permissions to rewrite the firmware of my laptop, yet it was signed “Unknown”! I’ll restrain myself from repeating the loud, table-thumping torrent of pungent expletives that issued from my mouth at this point. To release an OS updater that’s not digitally signed is incompetent, but to release a device firmware updater that’s not signed is sheer recklessness beyond my comprehension. What if a hacker had managed to modify that code and squeeze it back onto the Dell website? What are you supposed to do when confronted with such a situation? I did the obvious and went nuclear-ballistic at Dell (and no, you don’t want to read what I wrote in the emails to the PR department). Updating the core firmware on a computer is arguably the most trust-demanding thing you can do: it rewrites the core brain of the computer that starts up well before any operating system has been installed. It truly is the “soul of the machine”.

Dell released a new firmware updater a week later that was correctly digitally signed, and has told me that it has taken my criticism onboard – and that the Dell Update utility will be more thorough in its operation in future. For which I am

duly grateful. Be in no doubt that releasing drivers and firmware, or indeed any executable code, to the general public brings with it great responsibility. Is there a virus in there? Have we been hacked? Is it the right driver for the hardware? Has it been tested, approved, signed off and handled in an appropriate manner?

These recent events, both over the digital signatures and now the unsigned firmware-update tool, lead me to believe that Dell’s software management team is wholly, utterly and stupendously out of control. It should have been impossible for these problems to arise. Releasing unsigned firmware code shows that there are no meaningful management checks and processes in place. I repeat, it should have been impossible, yes impossible, for this to happen. That it did, and that the software division of Dell thought it acceptable to release those digital certificates (and indeed to write into their own management tool code to force-reinstall them if you had the temerity to remove them) takes things to an entirely new level of culpable incompetence.

I have no idea what Dell is going to do to fix this. Frankly, the board should be marching through their various software development and delivery teams with a flamethrower. This is the sort of screw-up that can irrevocably taint a company. I hope that Michael Dell reads this, and I hope that he’s as appalled as I am.



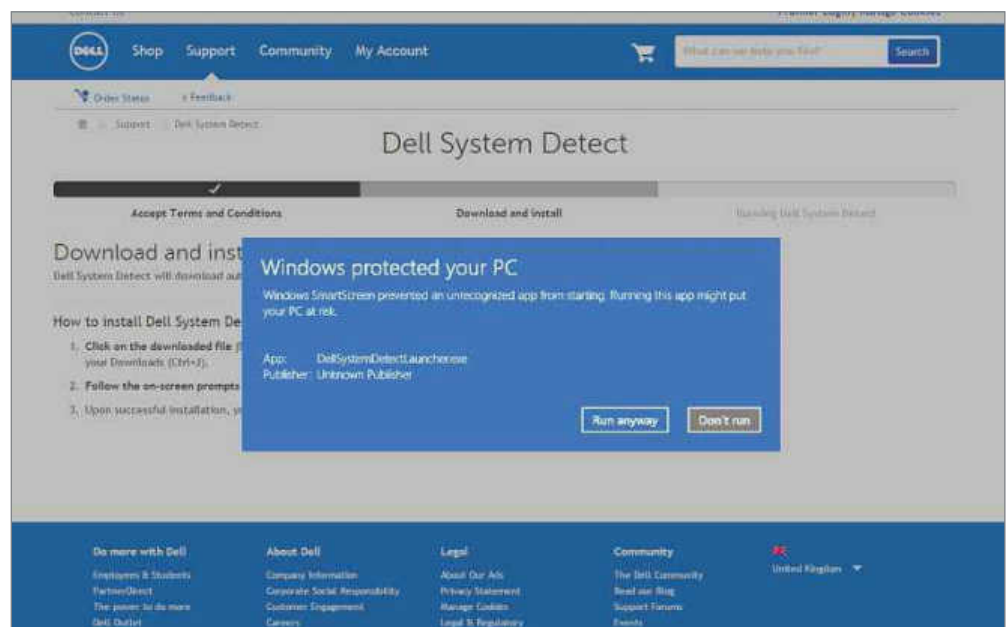
ABOVE The Dell XPS 13 is a top-quality product, but it has been hampered by software mistakes

I am, of course, going to keep a close eye on those XPS 13s. I do like them, I really do – they display a genuine effort to make a top-quality product. I can only hope that the good people in the hardware R&D team are patrolling the software dev teams, reminding them a product is the totality of the package. Will I buy any more Dell kit? I can’t answer that question at the moment. To screw up this badly just once can be forgiven, but to screw up several times starts to look like hostile action.

Self-updating firmware

Here’s a small prophecy for you. Any device that is capable of making a connection to the internet should be able to update itself automatically. Whether I want it to do that should

BELOW Another example of unsigned software from Dell



be a matter of management control, but the default – at least for domestic or small-business devices – should be automatic self-updating. I’m heartily tired of seeing those numbingly offensive firmware updates built into web pages that front so-called intelligent devices, offering to point the loader at a file that I’ve manually downloaded from the internet. Is that meant to be helpful? Of course, appropriate checks and procedures need to be in place, but even the biggest players seem unable to do that competently at the moment. This must get fixed, and get fixed quickly, if there’s any hope for our devices to stay workable into the future. This is particularly important for the huge numbers of Internet of Things devices that are going to explode in popularity over the coming years.

Medieval databases

Why are database managers still stuck in the Middle Ages? I recently wanted to take a simple stock-control system – which is currently crammed into a single-sheet Excel page – and turn it into something that multiple people could access at the same time from a range of devices. Given our propensity to run Apple hardware for our key internal operations, keeping all the Windows hardware for testing and analytics, it made sense to move to an Apple-based database solution. And, in that space, FileMaker Pro is still the daddy, being owned by Apple itself.

Over two decades ago, I could make Microsoft Access jump through hoops, but have things moved on during that period? It would appear not. Where’s the smart linking, the predictive solution builders, the ways of saying “take all this stuff and make it do that”? Nothing, and no help at all. Getting into FileMaker Pro is hard work, somewhat harder than I was expecting. I really don’t think that my expectations were too high – I genuinely believe the problem is that too little has happened over the past couple of decades. I should be able to easily point, click, squirt and rearrange to make stuff happen. But no, it’s all too much like hard work. Maybe I’m just getting old. Bah humbug, and a miserable 2016 to you all.

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PAUL OCKENDEN

“There’s no magic that can make smaller batteries last longer than bigger ones”

In the quest to make ever slimmer devices, manufacturers have been trimming battery size – but first, it’s time to talk home automation

Wearables and automotive technology are everyone’s predictions for the “next big thing” this year, and they’re the same things that were going to be huge last year. And the year before that. My prediction is that home automation (and its trickle down to small and medium businesses) will be the sector to see massive growth. I accept that we’ve all been predicting a home automation boom since *Tomorrow’s World* was broadcast in black and white but, half a century later, I believe the prediction will finally come true. The reason for this confidence isn’t the ever-expanding range of hardware and software available, although that obviously helps, but more the fact that I’m seeing so much noise about home automation online, and indeed in communications from readers of this column. But more about that later...

Let’s talk about home-automation kit. I mentioned Energenie here a few



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BELOW SmartThings from Samsung offers home automation in a box

months ago, a company that sells well-priced off-the-shelf bits and pieces for controlling both mains-powered devices and radiators (its range is slightly limited as it doesn’t include lighting dimmers, but I’m sure those are coming). Samsung’s SmartThings range appears to be another well-thought-out system, and although I haven’t played much with them yet, its products have the bonus of talking to many third-party Z-Wave, ZigBee and LAN-connected units in addition to Samsung’s own controllers and sensors.

Apple’s answer to SmartThings is HomeKit, which employs a slightly different approach to Samsung (and most other vendors). There’s no central hub device – it relies on an iOS device for that role – and HomeKit will only work over Bluetooth or Wi-Fi. If you want to use something such as Z-Wave, you’ll need another bridge. However, the best thing about HomeKit is that it’s tied into Siri, meaning you can say things such as “Siri, open the garage door”, which is pretty neat. In fact, if you own any iDevice and wish to extend this Siri integration beyond Apple’s HomeKit ecosystem, there’s a product called Homebridge – downloadable from [pcpro.link/258homebridge](https://www.pcmag.com/uk/258homebridge) – which is essentially a HomeKit emulator. It’s simple to install onto something such as a Raspberry Pi and, once you’ve done that, you can connect the Pi to your SmartThings hub and use Siri to control your various devices. I’m not sure whether Apple



or Samsung will be more annoyed by this software...

If you don't want to go down the "hub" route, there are several well-established companies that sell standalone controllers. The best known is HomeSeer, but there are also Fibaro and Zipato. Think of these as appliance boxes that you install in your house, a bit like burglar alarms. They fit into a cupboard, rather than being prominently displayed, and are controlled via a web interface or app. Each have their own strengths and weaknesses, but you'll find that, as well as Z-Wave and ZigBee, they'll control older X10 devices, and in some cases even antique infrared kit!

If you're a bit of a tinkerer who likes to understand how software works – and maybe modify it to suit you – then there are a couple of home-automation resources you should look at. The first is HomeGenie (homegenie.it). You can run this software on Windows, OS X or Linux (including Raspberry Pi) and it has a responsive web interface, with apps for Windows Phone and Android. Much of its development seems to have been done by one chap, but there's user support at homegenie.it/forum. The second option is one I've mentioned before, Domoticz (domoticz.com). This is open-source software, with installers for both Windows and Raspberry Pi. You can also run it on a Mac, but you'll need to compile it from source using Xcode.

The Domoticz project has been going for longer than HomeGenie, has a bigger developer base and, as a result, supports a lot more hardware. Unlike HomeGenie, Z-Wave support isn't built in, but instead relies upon the OpenZWave project, which isn't a bad thing. Something else I really like about Domoticz is that it supports Blockly for creating little automation routines. Blockly is Google's visual programming environment, and it's very simple to use. I use Domoticz to control not only electrical devices, but also my Evohome heating system.

However, what really interests me is what *you* are doing in terms of home automation. Have you used any of the products or systems I've mentioned? Do you have any hints and tips for other readers? If so, drop me a line at HA258@ockenden.com. I'll keep this mailbox alive while this



issue is on sale and then summarise your responses in a future column.

Bogus battery baloney

Are you as fed up with bogus battery-life claims as I am? In the quest to make ever lighter and slimmer devices, manufacturers have been trimming the battery size. They're all at it, and I have a couple of iPads on my desk that demonstrate what happens as batteries get smaller. It's a topic that's been cropping up recently in online conversations, and please don't interpret what I'm about to say as an attack on Apple alone because it applies equally to just about every tech manufacturer.

The two iPads are an iPad Air 2, currently the top of Apple's 10in (ish) range, and a fourth-gen iPad, which is two generations older. They both have the same screen size, memory capacity, connectivity options and apps installed on them. They're both signed in to the same Apple account, and the same email accounts with notifications enabled. To all intents and purposes, each is an exact mirror of the other. I do the same things with them, too: watch a bit of Netflix, iPlayer or Amazon Prime; stream content from the Plex server running on my NAS; check my email, Twitter and Slack feeds; play *Scrabble* with my parents; play *Threes* by myself; check the news and weather; set stuff to record on my Sky+ box. Both iPads get a similar amount of use. Why do I have two? One's upstairs and the other is downstairs (yes, I am that lazy!).

I should make it clear that I don't notice any performance difference between the two tablets. I realise the Air 2 has a far faster CPU and graphics

ABOVE Domoticz is a very mature and flexible home automation system

"Dig deeper into the specs and by far the biggest saving is from the battery"

BELOW Smaller, thinner, lighter, but will it perform for as long?



system, but it's wasted on users like me. If you play the latest high-res driving games or immersive first-person view, you might spot a difference. Or if you use your tablet for rendering video or re-encoding audio (why would you?), you might appreciate the newer, faster hardware. However,

when streaming video, checking web pages, playing simple games and using productivity apps, I notice no difference. None. Nada. Zilch.

So what else is different? Let's start with specifications. Their screens have the same number of pixels and are pretty much indistinguishable, but the newer iPad has a narrower bezel and is thinner. You wouldn't think so by looking at it, but the older iPad is almost 1cm thick (rounded edges are a psychological trick used byproduct designers to make things look thinner). Ignore those curves to make the geometry calculations a bit easier and the fourth-generation iPad occupies around 421cm³, while the same calculation for the newer iPad Air 2 yields 248cm³, so it has a little over half the volume of the older model. The newer one is also lighter at 444g, while the older model weighs 662g.

So where have these savings been made? Some of it is down to improved packaging, which you can tell from the densities of the iPads: 1.52g/cm³ for the older model and 1.79g/cm³ for the newer. Some of the electronic components are a little smaller too. However, dig deeper into the specs and by far the biggest saving is from the battery. Apple doesn't publish the battery capacity of its devices, but various third-party websites such as ifixit.com have pulled the things to pieces (a "teardown") and found that the fourth-generation iPad contains a 3.7V, 42.5Wh battery. It's the watt-hours (Wh) figure that matters when you compare batteries because that's the total power available. But, confusingly, most batteries are advertised

with ampere-hours (Ah). We are talking simple DC here, so volts times amps equals watts, and for the iPad 4 that gives 11.48Ah. This is usually expressed as 11,480mAh, since 11,000 sounds bigger than 11! Compare that with iPad Air 2 and the battery capacity has dropped from 42.5Wh to 27.62Wh...

That's quite a drop. In fact, the drop wasn't so sharp because the intervening iPad Air had a 32.9Wh battery, making the reduction more gradual, but the battery has been getting smaller, allowing the tablet to become smaller, thinner and lighter. Yet, for each models, a shiny grey man has stood on a stage at a "keynote" event in California and told us that battery life hasn't been affected. "Still the same great ten-hour battery life!" is the usual claim. If you've ever been to one of these events, you'll know that this is always met by an embarrassing cacophony of whoops, high-fives and air-punches.

So how do these ten-hour claims stack up? Let's start with benchmarks. PC Pro uses a looping video test to measure battery life, as do many other printed and online tech journals. PC Pro, of course, does it better than most by making sure that the screens are calibrated to exactly the same level of brightness, and by setting the tablets to Flight mode. In these benchmarks, both iPads came within a whisker of each other at between 12 and 13 hours. So maybe Apple's claims are true? Perhaps they've managed to optimise the tablet's hardware and software to squeeze more juice from a smaller battery? Well, yes they have, if you're watching a looping video, but in my real-world use, the newer iPad lasts for around 30% less time than the older one before it needs charging.

Let's not forget that my older tablet has been recharged many more times, meaning its battery capacity has started to shrink slightly, and it still has much more stamina than the newer, lighter and smaller model. I don't think anyone should be too surprised by this. There's no magic that can make smaller batteries last longer than bigger ones, and if there's optimisation available in software, it will apply to older and newer models since both receive OS updates.

I said that this isn't a rant at Apple because all the manufacturers are

doing the same. Tech companies seem to think we want ever-thinner devices and, as a result, we see battery life suffering. I wish they'd be more honest about it, rather than sneaking in optimisations to make sure their newest models with smaller batteries sail through typical benchmark tests without embarrassment.

Oh no, not not-spots

Finally, an update on mobile not-spot solutions. You may remember I wrote nice things about the Nextivity Cel-Fi Pro a few months ago (see issue 254, p113). Well, it appears that some of you have had trouble getting hold of one. The following is an email that I received from Andrew Crossley:

"I bought the Cel-Fi version 2 a year ago and it made a huge difference – until they upgraded our local mast to 4G and then my phone started getting confused about whether to use a strong 3G signal or weak 4G signal. I thought I'll upgrade to the new Cel-Fi Pro but it was 'out of stock'. I eventually phoned up and was told they're renegotiating with O2 and can't sell them at the moment. The EE signal booster is also not available and I thought they used to sell a Vodafone flavour, but I see that's not available at all. It all smells as if the mobile heavies have decided to make life difficult for a successful company providing a solution to the disconnected world. I know you're a fan so thought you might be able to get a little more information from them and possibly apply a little publication pressure on the mobile operators not to get in the way of this great product."

I think you slightly overestimate my power, but I spoke to Nextivity via its UK partner, Frequency Telecom. A spokesperson told me: "The situation is different for each of the networks. For O2, the merger with the Three network in the UK had raised some issues with the setup for the Cel-Fi Pro – however, all is now sorted. We're due a delivery for the UK and will have them back available on the site by tomorrow. With EE, we were

ABOVE Readers reported having difficulty getting hold of the Nextivity Cel-Fi Pro, but they're now back in stock

"Whenever networks merge, two opposing clans of techies are forced together and seem to indulge in a geek-off"

scheduled to release a version of the Cel-Fi Pro during late 2015, but it has been delayed due to some last-minute changes in the configuration. This should be resolved and the Cel-Fi Pro released in early 2016. As for Vodafone, while the Cel-Fi Pro is available for Vodafone in several other countries, the availability in the UK is limited as we're going through an extended period of testing with Vodafone UK. We hope to resolve this in 2016 also.

"We would never want to provide a service that we ourselves are not 100% happy with, and therefore made the decision to take them off the website as we did not want to disappoint customers with a waiting time for 'out of stock' products that we were not sure of the next delivery date for."

"Regardless of all the different network situations, we're looking at getting all options back in stock ASAP. I hope this answers some of your reader's concerns."

You'd think that, with all the mobile networks converging, problems such as these would be less frequent, but I'm hearing similar tales from across the industry. Wherever networks merge (or share masts), two opposing clans of techies are forced together and seem to indulge in a geek-off, each side posturing to demonstrate their superior geekdom. This slows down or stops the normal development and product-approval processes. I can understand why this happens: a combination of pride (each side wants to be the best) and worries over job security. When two networks merge or share facilities, an awful lot of people will no longer be needed, so the two clans are trying to rubbish the work done by the other. This creates what one industry insider described to me as "virtual treacle".

True to their word, Frequency Telecom now has the O2 units back in stock and showing on the Cel-Fi website. I also checked with Andrew and he's placed an order for one, so at least this story has a happy ending!

 @PaulOckenden



SAM MARSHALL

“Every time somebody set up a new project, they spent time reinventing things that already existed”

Giving teams Office 365 and expecting them to just get on with it is like installing a kitchen without teaching cookery

Office 365 may be a success story for Microsoft in terms of sales but, when you look at how people work, not much has changed since Office 2003. Take a team I recently helped, who wanted to improve how they managed projects in their organisation. They saw it as a knowledge management issue: every time somebody set up a new project, they did it in a slightly different way and spent time reinventing things that already existed.

So, they asked for a “knowledge-management system”. However, it soon became clear that they didn’t need a specialist system at all – they needed to work more consistently – and the tools they required were already available. They had access to Office 365, but were really only using it as a glorified shared drive. The trick was to configure Office 365 to make it look like the world of project management they were used to.

When Sites go wrong

Sites are one of the most powerful elements of Office 365. Although only one tile in the menu, they are the gateway to a full SharePoint implementation.

SharePoint goes back to 2001 and has its roots in document-based team collaboration. You’d think this would



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“Left to their own devices, everyone would come up with their own solution”

BELOW When you create a site in Office 365, there isn’t much that says “project management”

make it a good basis for project management. In practice, when you set up a new site in Office 365, it’s pretty sparse. The site owner has the freedom to add and remove elements on the page (called “web parts”) as much as they like and this flexibility makes SharePoint powerful, but it’s rarely used well. It’s like staring at a blank sheet in Excel and being asked to use it to manage business accounts: left to their own devices, everyone would come up with their own solution, and few would be optimal.

I’ve seen many team sites that have a landing page featuring a two-year-old discussion. The first post usually says “Hello” and the second is the same person replying to themselves saying “Test”. Even if the site is well used for document-sharing, these dead areas send out a message that the site is a ghost town. My first advice is usually to switch off most of the functionality and only add it back when you know you need it.

In the case of my client asking for knowledge-management help, people either used sites without any changes or customised them, which led to a lack of consistency in project approaches. When we talked to people about how they actually worked, a common pattern of needs emerged: 1) communicating status and project

deliverables with stakeholders, 2) sharing a project plan at a high level, 3) sharing work in progress, and 4) templates and example documents for things such as budgets and risk logs.

For the first two needs, we set about creating a site template with a common layout for these elements. We wanted to create a “shop window” for each project, aimed at the people outside the team who needed to know how it was progressing or access one of the deliverables. Sometimes, they just needed to know what the project was about. Standardising the layout and content made it much easier for visitors to navigate between projects.

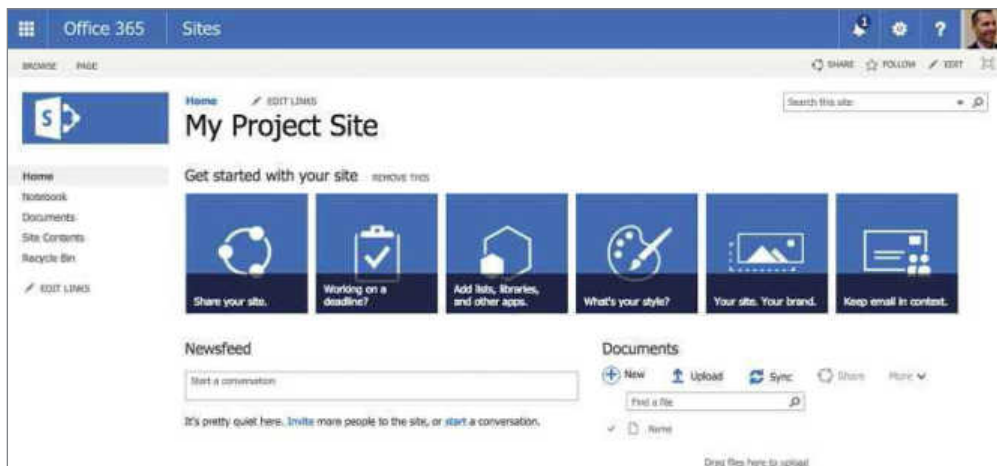
The third need, sharing work in progress, is easy in Sites: you need to create a document library for the team members. There’s a philosophical debate in the SharePoint world about whether you should let people use folders or force them to use metadata, but when it’s only a team working together, my feeling is that you should let people use folders. Getting them working with collaboration tools can be a challenge, so you need to pick your battles. What won people over wasn’t so much the document library, but showing them how to access it in Office 2013 from the File menu. People also wanted to work on documents offline, so demonstrating to them how OneDrive synchronises the library with their hard drive was a big plus.

Once you have your design right, you can save it as a site template and create new instances of that site at the click of a button (support.office.com has a step-by-step guide). You can even prepopulate it with standard documents so that people don’t have to hunt for templates every time.

Setting up traffic lights

The team was keen to also have a “traffic-light” dashboard view on the project homepage. This would show at a glance if each project workflow was on track. Keeping to our out-of-the-box philosophy, we initially did this by setting up the dashboard in Excel Online, using conditional formatting to set the colours in a table. We then showed those cells on the site homepage using the Excel Web Access Web Part.

All of this just takes a little configuration, no code required. Although this solution worked, it is rather convoluted and we couldn’t really expect a project manager to be able to change the formatting. We did consider buying a third-party web part at this stage, but getting it



approved and installed by IT would have created delays.

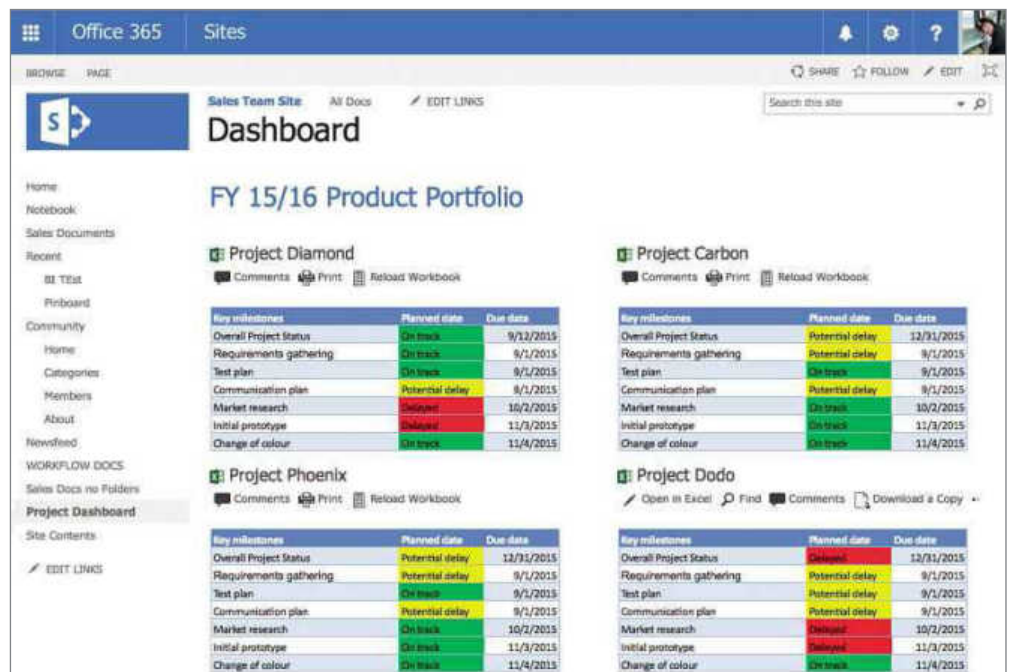
In the end, most project managers stuck to creating status reports in PowerPoint. Sometimes you need to pace the changes you ask people to adopt. To integrate the reports with the template, we put the key slide as a preview on the Site page. An easy way to do this is to view the presentation in PowerPoint Online and then select “</> Embed” from the “...” menu. Once you’ve selected the size you want, paste the code into any SharePoint page by selecting Insert and then “Embed Code” (also known as a snippet). This approach works for Word and Excel, too.

The people problem

Coming back to the original problem, Office 365 was never going to fix everything. A more fundamental challenge was that people liked working in slightly different ways. Although individuals said they wanted standards, they would also argue why their project was a little bit special and, therefore, had to deviate from the standard.

This is the other problem with SharePoint: you can lock down processes so much that people find it stifling. If you do, people will do their best to avoid SharePoint entirely and carry on using email attachments or even Dropbox, only uploading it to a site when everything is finished.

Rather than being too strict with templates, we set up another site as a hub for the whole team. This one contained a toolkit of templates



and good examples. We didn’t dictate that they should be used, but hoped that by making good examples available, they would be reused, not reinvented.

Such an open toolkit approach can soon become disorganised, like a self-service library. This is where another Site feature comes in handy: document libraries can have their own metadata and customised views. This makes it easy to add things and sift through a large collection.

The first thing to do is to agree on common labels for document types – say, Template, Example, Policy, Tips – and create a column with these as pick-list values. You can then create buttons that flip between filtered views, much as you can when

ABOVE The team wanted a traffic-light system for projects, which we built thanks to SharePoint’s ability to show Excel tables on a page

BELOW PowerPoint Online will generate the code to embed a preview on a SharePoint page

searching on Amazon or Kayak.

You can also add a search box just for that library, which can help when you have users with limited search skills.

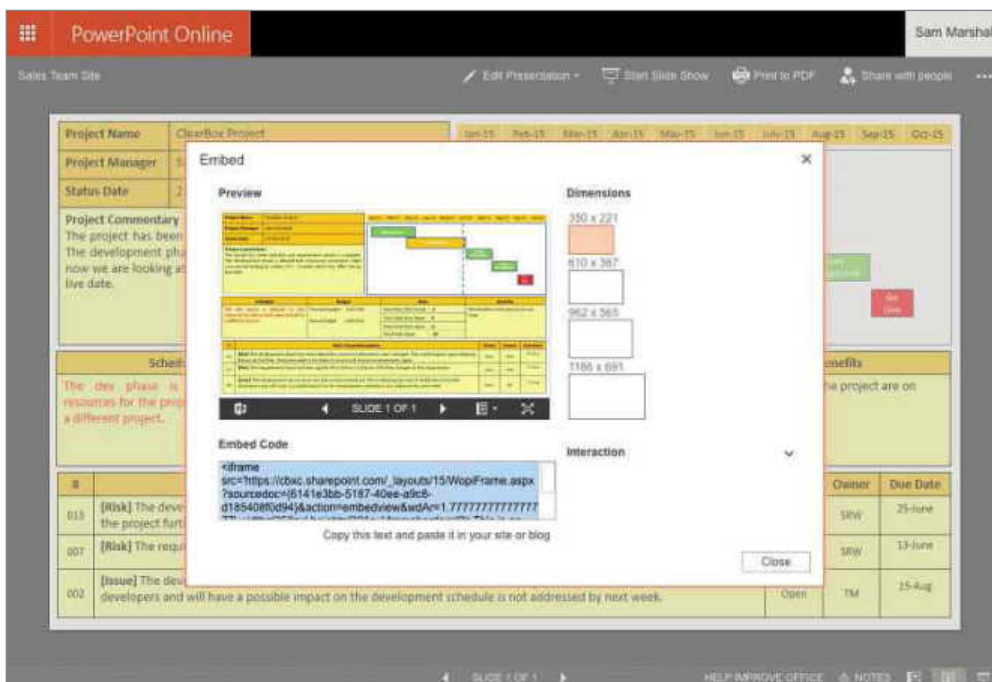
Yammer: it’s good to talk

The last thing to tackle was how to get the project managers to actually adopt this approach. Of course, we did some initial training and introductory sessions, but that was really to familiarise them with how we’d set up Office 365. Remember, we weren’t so much bothered about them using Office 365 as changing how they managed projects. A heavy-handed memo by the boss might work in some companies, but that wasn’t really their style. So instead we turned to Yammer as a way to encourage people to share good practice simply by talking about it with their peers.

Yammer is the key social media tool in Office 365, a little like an internal Facebook. We set up a specific group for project management and invited not only the team, but others around the organisation who were also working on projects. The main advantage of using Yammer was that we could create a sense of community that extended beyond a single office. Yammer became the place where project managers asked for help, and we could direct them to the templates and gather feedback for refinements.

Microsoft is evolving Office 365 rapidly. For example, it looks like the new Groups feature will displace SharePoint Sites in many instances. Like anything else in Office 365, though, these are just the cooking utensils: you don’t have to use them all to make a good meal.

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DAVEY WINDER

“The social media phishing problem can be described in just two words: exaggerated trust”

If it only takes ten minutes to train employees against social-engineering attacks, why aren't more organisations doing it?

Social engineering, in the form of email phishing, remains the most common type of online attack, and the harsh truth is that everyone should know that by now. A safe way to learn is by exposing people to sandboxed versions of the threat, and PhishMe is one organisation that employs simulations to train employees to identify and mitigate such threats. At the end of 2015, PhishMe published its “Enterprise Phishing Susceptibility Report” (pcpro.link/258phishme), which analysed the year's data from 400 customers. Admittedly, the majority of its 4,000 or so simulations were done in American companies with 1,000+ staff, but the technique scales well to smaller enterprises in different countries. The important statistic in the report is that 97% of the trainees became less susceptible to thoughtless clicking after only four sessions of a little over two minutes each. If it takes only ten minutes to train folk against social-engineering attacks, why aren't more organisations doing it?

Maybe they are, but are doing it wrong. I've had experience of smaller businesses who fell victim to phishing attacks, despite what was thought to be adequate training. Their problem was that their training only dealt with email, but they were attacked via a different route. Security vendors now suggest that 20% of phishing attempts are made using social media, but this message doesn't seem to be getting across. Marshall McLuhan famously held that “the medium is the message” – that is, the medium alters your perception of the message's content – and this applies to social media phishing attacks. We've taught users that not everything that arrives by email is trustworthy, but they don't extend this to social networks where



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“Security vendors now suggest that 20% of phishing attempts are made using social media”

BELOW Simulating social-engineering threats is both efficient and effective

they're supposedly operating among a circle of “friends”. The social media phishing problem can be described in just two words: exaggerated trust.

I don't have statistical evidence but, anecdotally, it feels as though targeted social media phishing attacks are on the up. These attacks don't use the normal scattergun approach, messaging lots of people to garner enough clicks to make it pay, but rather tread a far narrower path to profit. “Spear phishing” itself is nothing new – serious criminals and state-sponsored spooks have been successfully using it for donkey's years – but pointing the spear at a single target, who has been carefully researched via social media to create a customised “bait”, is new and highly effective. Information gleaned from social media profiles drives much recent email spear phishing, too: such profiles often reveal far too much personal and, almost inevitably, corporate information to all and sundry. Even those savvy enough not to leave their accounts open to full public scrutiny still often fail the “who is this person?” test for online friendships. Collecting Facebook friends or LinkedIn contacts like Pokémon cards is a bad idea that opens you to scammers, and reveals personal data they can deploy to amplify an already implied trust.

My friend and security lead at LogicNow, Ian Trump, hit the nail on the head when he pointed out recently that a survey of managed service

providers discovered that only 6% were worried about social media attacks. More staff are joining organisations for whom a social network, rather than email, forms the primary means of communication, so it's precisely the wrong time to be discounting social media as a security problem. At least email remains fairly confidential until it's compromised, but that can't be said about social media where sensitive information is on display. Accidental disclosure is a big problem: our comfort level in the trusted social environment leads us to hold conversations in public that we really shouldn't. These conversations might be seen by any contacts with access to our circles, and used for nefarious purposes.

Train and train again

So what can be done to make social media more secure in the workplace? Education remains the key, and staff training (especially through PhishMe-style simulations) can quickly reveal which employees need the most attention. And it's not only Facebook that's being targeted by the bad guys: when talking about business-orientated phishing, you might expect LinkedIn would also be an attractive place to focus attention. Indeed, Symantec recently uncovered a host of fake LinkedIn accounts, covering a slew of industry sectors. This is exactly the kind of “trust traction” play that you must look out for.

Fake accounts ask you to connect, and may have already fooled several of your real connections, which adds to the likelihood of the request being accepted. Be careful who you connect with and endorse on LinkedIn, as a fake account with a large circle and endorsements is a valuable resource for the bad guys (and a difficult one to spot). It's not unreasonable to only connect with people you either know directly, indirectly or have at least heard of. The fakes that Symantec discovered were dealt with by LinkedIn, which deleted them for



terms-of-service violations. However, what was interesting was the pattern followed, almost like a template, by these criminals.

A recruitment agency is probably the most common tactic for fake profiles, using data cut-and-pasted from real recruitment professionals as the profile. They fire a double-barrelled blast of flattery and greed that works almost every time unless you're on your guard. And most LinkedIn users I speak to – outside of the security industry – are quite simply not on guard. The mere notion of scamming via LinkedIn is barely imaginable to them, which makes LinkedIn a very dangerous place. More dangerous, in fact, than Facebook, where there's at least some awareness of risk. Three of the five small-business owners I spoke to about social media security said they'd never publish detailed information about their projects and partners on Facebook, but four of them would do so on LinkedIn, because "that's what it's for, isn't it?"

Such "what it's for" and "what to put there" debates are heating up, but not doing much to relieve the confusion. Yes, social networks are for socialising and corporate networks are for corporate networking – that is, until you start corporate networking via social media and vice versa. Any security expert will tell you that separation is one basic rule for keeping things secure. Keep your highly sensitive data away from your everyday, non-confidential stuff. Why would you mix company information, potentially highly valuable to the criminal fraternity, with social chitchat? It makes no sense if you apply a modicum of thought, does it? That said, you need to understand what's valuable data and what isn't, and even that can change depending upon context.

I had this conversation recently when someone asked whether I knew that Facebook was telling everyone it was my birthday. I did, and I didn't much care since that's the kind of data that's very easy to find if someone really wants it. Why hide anything on Facebook that's available elsewhere to a determined searcher? I'm not talking about classifying your data along government security policy lines, merely applying common

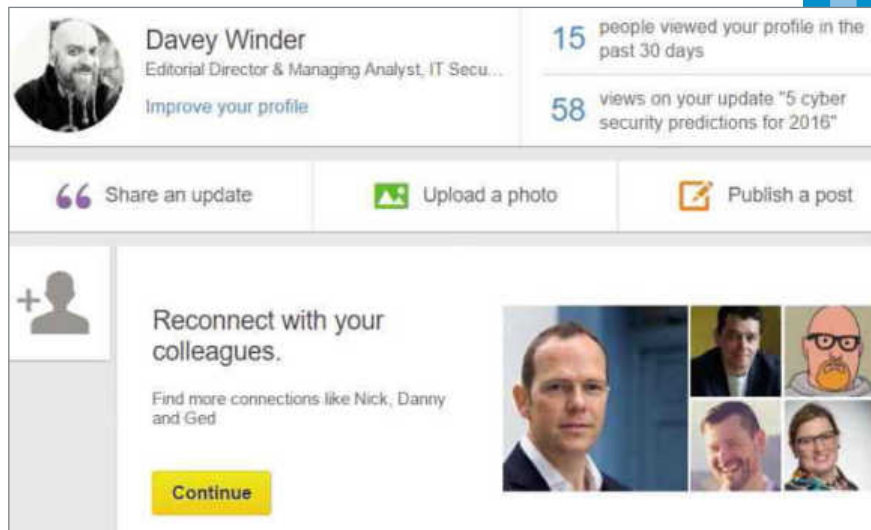
sense to what you say and where you say it. It also matters who is saying it. Privileged access can become a thorn in the side for any security policy if access is escalated to users who shouldn't have it. The same goes for social media access when it comes to the corporate account: only nominated individuals, or job roles, should have the ability to post to official company accounts, and those nominated posters should be fully trained in the risks, as well as rewards, of using social media in business. Sharing privileged accounts is a big no-no, whether deliberately or via a credentials hijack.

That means the same levels of login protection should be applied to your social media activity as to any other privileged account. Two-factor authentication should be employed wherever the social media service offers it, and password reuse is never acceptable. Simple rules can make a huge difference to your social media security. The simplest rule of all is to restrict management of social media accounts to as few people as possible, reducing the opportunities to compromise credentials.

State-sponsored social media hacks

Staying with social media security problems, last October the chief security officer at Facebook, Alex Stamos, made an announcement that left me puzzled. In a statement entitled "Notifications for targeted attacks" (pcpro.link/258facebook), Stamos said that, with immediate effect, Facebook would "notify you if we believe your account has been targeted or compromised by an attacker suspected of working on behalf of a nation-state". Stamos' reason for this extraordinary warning was that these attacks are generally more advanced than ordinary account compromises, meaning Facebook "strongly encourages affected people to take the actions necessary to secure all of their online accounts".

That makes little sense to me. A compromise is a compromise, and accounts should be secured regardless of the culprit. Anyone whose account is being targeted by state-level snoops



ABOVE Only connect with people you know on LinkedIn

"Simple rules can make a huge difference to your social media security posture"

ought to be already well aware of the need for account security. Facebook informing you that your account has been compromised and "it was China wot done it" isn't helpful (although, admittedly, more so than just being told "someone" from "some country" with "state backing" has hacked you). The trouble is that Facebook has no intention of telling you whodunnit. On rereading Stamos' statement, you discover that "to protect the integrity of our methods and processes, we often won't be able to explain how we attribute certain attacks to suspected attackers". So, erm, what's the point?

I'm asking this again because Twitter has also jumped aboard the vague security warning bandwagon. It has also decided that warning users their accounts have probably been targeted by state-sponsored hackers – without providing any meaningful evidence of who, how, why or when – is a good thing to do. The first people to receive these Twitter notifications, who included security researchers and political activists, appeared confused by the vagueness of the things. "We have no evidence they obtained your account information, but we're actively investigating," the emails stated, along with "we don't have any additional information we can provide at this time". Gee, thanks Twitter. That's about as helpful as pointing out that your account may not even have been the intended target – which those emails also did by the way.

What rubs me up the wrong way is that I have no doubt Facebook and Twitter have much more information than they're passing on, as these kind of warnings wouldn't be sent on a whim. If my account has been targeted, then either tell me what you know or tell me nothing. The former might help me determine the best action to take to further secure things, while the latter would stop

Continued from previous page

me worrying about things I can't control and can only guess about...

I'm not denying state agencies employ social media as part of the reconnaissance stage of an attack – that's all but a given – but without technical detail, such warnings are about as much use as Hotmail informing you that someone has sent you a malware attachment without flagging the message concerned. You may become more vigilant as a result, but you can do bugger all about the direct, specific threat.

Speaking of Microsoft and Hotmail, guess what? Yes, it too is joining the "warn your users if nation-state actors target their accounts" club. This follows the news that attempts were made by what were believed to be government-backed hackers to infiltrate Hotmail accounts in China. Microsoft's decision may have been made after news broke alleging that Microsoft had decided not to let thousands of Hotmail users know that their accounts had been hacked by state actors, supposedly going as far back as 2011. It wasn't that Microsoft did nothing – it asked the account holders to change their passwords, which is a good mitigation response, but not as good as giving them the details of the threat and enabling them to revise their security posture. Don't expect such technical background information, though, as Microsoft is also following a policy of "evidence we collect in any active investigation may be sensitive, so we do not plan on providing detailed or specific information about the attackers or their methods".

While we wait, most likely in vain, for a change of heart over such useful information-disclosure policies, what can be done to make your email and social media accounts more secure? The old advice still applies, and that means using two-step verification in combination with a strong password, being sensible about who you connect with, the links you follow and the files you open. I would throw in a bit of account auditing, too, even if this only means watching out for unusual activity each week, and applying OS and browser/app patches to minimise the attack footprint.

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STEVE CASSIDY

"All the tech journalists could be seen wincing every time someone uttered the term 'cyber' something"

A trip to the House of Commons leaves a minister of state annoyed, and another Exchange disaster looms over Christmas

It's like the cats versus dogs thing: columnists exist to ask questions while ministers exist to avoid them. This particular encounter wasn't my first brush with the higher echelons of government, but it was my first visit to the House of Commons. The event was a round table sponsored by hosting giant Equinix. The topic was "cybersecurity", something I'd normally leave to m'learned colleague Mr Winder, but on this occasion it strayed closer to my remit since it was all about improving security by moving your data into the cloud (or in this case, preferably Equinix's cloud).

At least, that's what the advance publicity claimed, but the agenda took a right turn as soon as Equinix's UK MD Russell Poole finished talking. From sober assessment of the advantages of running B2B e-marketplaces inside the same data-centre fabric, we jumped to cybersecurity as perceived by the Rt Hon Ed Vaizey, HM minister of state for culture and the digital economy. Yes, I'm being super-careful by employing the word "perceived" there, and yes all the tech journalists could be seen wincing every time someone uttered the term "cyber" something. However, the factual message is easy to summarise, and something to which you should certainly pay attention: Her Majesty's Government has begun to respond to the problem of business information security by putting together the National Cyber Security Programme.

The best starting point is to read up on what the Cyber Essentials Scheme involves at [pcpro.link/258sc1](#). That's a direct order, so grab the PDFs, shut your office door and don't come out until you've finished. Cyber Essentials is already halfway to becoming a regulatory framework, not least because – as the minister pointed out – you can't now become a government contractor unless you've gone through the processes and ticked all

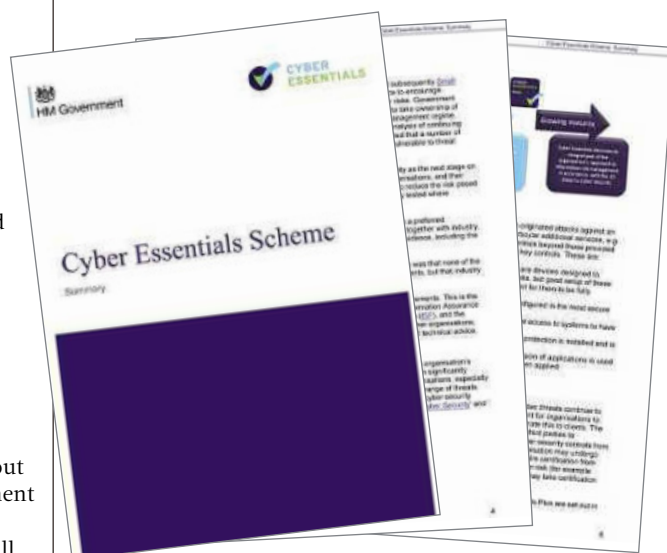


Steve is a consultant who specialises in networks, cloud, HR and upsetting the corporate apple cart
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the boxes. A grade-one wake-up call if ever there were one. I'm sure the man in the street will be able to follow its rationale, which is that it's not very sensible for anyone to do business with a counter-party who might simply steal all their personal data and sell them to the first mug to come along on the Dark Web. The key word there is "might". We simply don't do business with one another, in most run-of-the-mill transactions, in a way that grants us a perfect, transparent view into each other's entire digital life. This limits the level of confidence we can ever have that the person or company we're transacting with has even the most basic levels of precaution or awareness.

The facts behind this initiative are inescapable. We wouldn't have a problem with online fraud and identity theft if people thought enough about security when poking around on a computer, or hiring staff or subcontractors. At the same time, however, the gap between the man in the street and the experienced IT observer could hardly be wider. The first few steps towards encouraging take-up must be to mix a degree of coercion (that "no government work without this" warning) with a degree

BELOW The Cyber Essentials Scheme is already halfway to becoming a regulatory framework



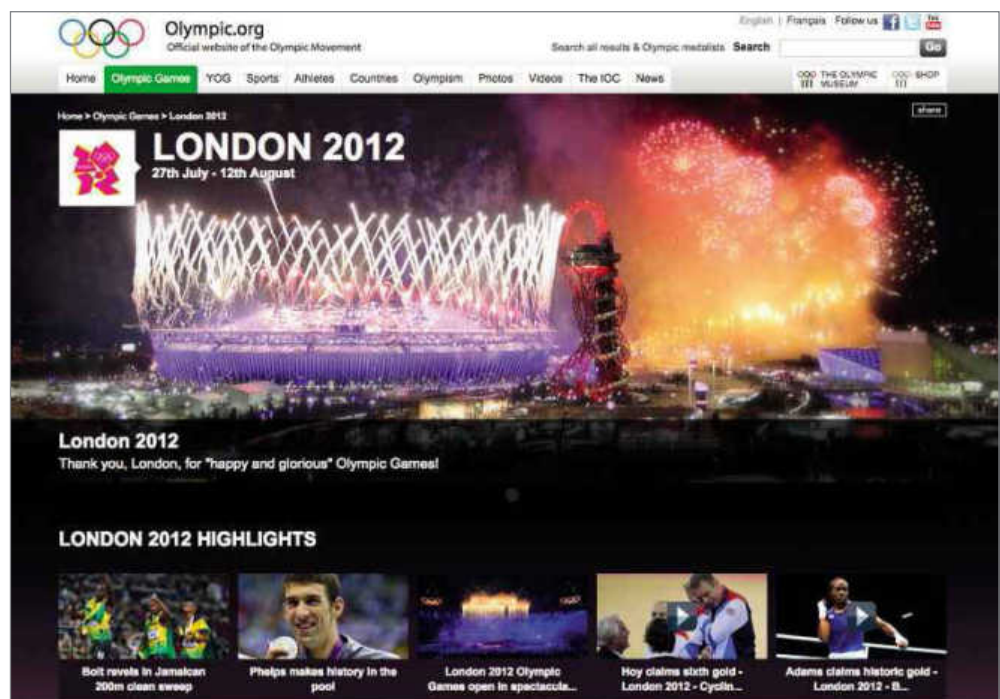
of acceptance that getting fully up to speed won't happen overnight.

This is my way of saying, sadly, that I found this panel discussion very "political". The whole presentation seemed to be based on sharing painfully ignorant statistics. I disliked in particular the conflation of two security factoids: the first was that during the 2012 Olympics, BT reported "over 200 million attempted hacks" of the Olympics website, while the second was the total number of data-theft episodes over the previous year (not such an exact number, and somewhat interrupted by lots of giggling about the Ashley Madison leak). But the implication of juxtaposing these two factoids was that the one leads to the other – that because they're loosely connected by the shared word "hack", they're therefore somehow signs of the times, amounting to a huge imperative to become more, cringe, "cyber-savvy".

I beg to interpret these facts differently. The 200 million network packets hitting BT's Olympics firewall over a month were like rain on the roof: they had barely any guided intelligence, just tiny taps and tickles intended to sniff out any foolishly open ports or services. That's not the same as 200 million serious attempts to get in, each using a subtly different strategy from some master criminal – it's more like a million idiots leaving their automated penetration testers running the same juvenile, repetitive probe 200 times each.

Elevating this passing traffic to the same threat category as the Ashley Madison hack is a painful misrepresentation, and one that makes me worry about how well the person who deploys it understands the domains of these two problems. If that Olympic statistic – those "200 million hack attempts" – is like rain falling on your roof, then real data breaches are more like someone taking a chainsaw to your jacuzzi. Both involve the same elements – water in the metaphor, data in the reality – but no, they don't have the same causes, effects, remedies or consequences.

The fix for 200 million of anything hitting you from the internet is to choose a sufficiently fast firewall, or a clued-up hosting company. The fix for a data breach of the Sony, Ashley



Madison or Wetherspoon's severity is to place a body-frisking search station for all your employees at the exits to the building, plus an application firewall that stops them using social networking or chat sites from their office computer. (Good luck implementing that, incidentally.)

It was the absence of any grasp of the chalk-and-cheesiness of the comparison that caused me to lose sympathy with the whole panel, and hence to phrase my question to them too aggressively. "Having been peripherally drawn in to the aftermath of a large-scale internet crime, I have some experience of what actually happens when a member of the public tries to report a cybercrime to the police. In essence they write your number down as a complete nutter, and say they'll get back to you. While the audience for Cyber Essentials is supposed to be companies, these are made up of individuals, and the individual experience of government responses to these threats has been poor. Are fixes for these issues included in the cybersecurity initiative, or not?"

This got the room chuckling, and for me at least it also prompted the best reply from one of the other panel members, to the effect that the most common reaction from front-line police when confronted with a trail of evidence of large-scale web fraud, was to find any reason whatsoever to claim that it fell in someone else's jurisdiction. The official response was that, if anywhere, the Cyber Essentials sites and resources would be a better place to bring up the possibility that an activity is actually symptomatic of a security problem.

ABOVE BT reported 200 million network packets hitting its Olympics website firewall

"Businesses have a ton of catching up to do to become even half as savvy as the guys who are targeting us"

This brings me neatly to why you shouldn't Google "cyber essentials". Despite this being a government-led programme, the Cyber Essentials site isn't faring well in the search-engine stakes: it's in a fight with sites run by both approved and unapproved consulting operations, who vie with one another to help you through the "10 Steps to Cyber Security".

Given that the whole issue is driven by the way ignorance grows into experience, and how prescriptive the government would like to be about making businesses get this qualification, I think it's only sensible for them to make the various affiliated resources behave nicely. In this case that means not fudging whether or not they're the real Cyber Essentials site, and putting equally unambiguous links to the real site on their front pages. Yes, I know that sounds nannyish, but the fact is that British businesses have a ton of catching up to do to become even half as savvy as the guys who are targeting us, our money and our jobs. I don't mind being rude to a minister with that as my aim.

Exchange Christmas present

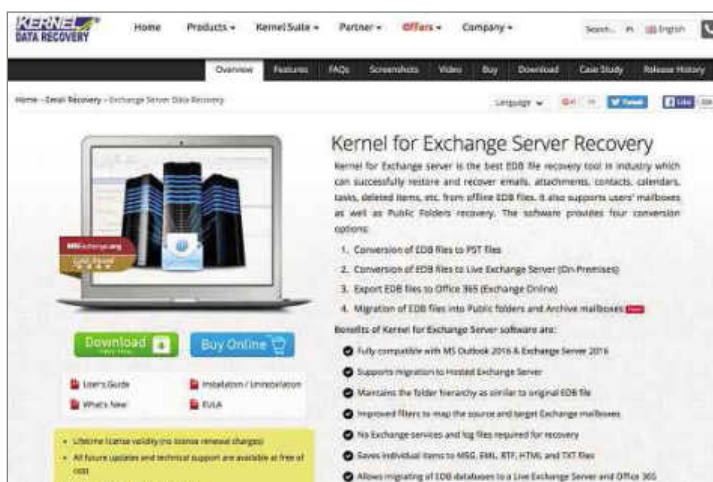
Christmas 2014 was a bit of a washout, as I was drawn into the classic nightmare of trying, against the clock, to recover a poorly built Exchange installation. It had finally fallen apart due to poorly built hardware selected under even worse time pressure. And then, as we arrived at the dog days of December 2015, my phone rang with exactly the same type of creeping horror looming over my Christmas. Initially the symptoms seemed harmless enough: a user couldn't get Exchange ActiveSync

or the web interface to let him into his mailbox. Then the first-try repair and move tools didn't seem to finish in quite the usual ways, and finally more mailboxes started to report the same error and the server began to run out of memory.

This was a new customer who wasn't yet used to the idea that international travel is no barrier to a bit of remote debugging these days. He hadn't called me at stage one and was pretty reluctant to even at stage four, because he felt this was just a mailbox problem, albeit a rapidly escalating one. So instead of me getting to take a preliminary look from my friend's house in Scheveningen, my man called in an Indian remote-support team. I almost had enough time to drive back from that leafy Dutch resort to London before the tasks they set running on his message base could finish (that's because, despite being prepared to take on the job, and also to send him an immediate invoice for £350, they didn't know enough about Exchange to stop all the server's other processes before triggering the file checker).

I eventually got to take a look from my favourite hotel, while he was busy refusing to pay the remote-support team's invoice. It was nightmarish. Not only was his EDB file so corrupted that the standard utilities wouldn't touch it, but the backups weren't usable either, and the server was running like a three-legged dog on Mogadon. A 300GB EDB file certainly takes some time to put through an integrity check, but not the nine hours that our Indian friends had left it running for. A quick check of the overall platform once I was back in his server room (a day later – that was quite some drive) showed that the iSCSI store used by his Exchange box was moving data on and off disk at an average rate of 4.5MB/sec – about half what I get from my oldest USB key...

The underlying problem wasn't that the Exchange database was corrupting – there are other EDBs in this deployment that are four times as big and running very nicely – but that the iSCSI service was running on a Parallels Cloud Storage server. Parallels assumes that jumbo frames are turned on in the network switch it talks through. The lack of jumbo frames produces



an epic cascade of retries, which are normally hidden from human eyes by the nature of accumulated Exchange data in server-side databases. It creeps in, you see, slowly and stealthily, without stressing the server it lives on, because an Exchange user generally isn't sharing the data they collect with tens or hundreds of people simultaneously: the message router does that for them. The other key indicator, for me, was that various temporary directories that Exchange uses – and there's a lot of them, scattered all over the machine – were suspiciously large. I had reason to believe that no appropriately skilled administrator had been near this setup for a good few months, so if there had been any warning signs of the corruption sweeping over this particular message base, nobody would have been looking at them.

Logging in to the managed switch that links the server with the Parallels box took 20 seconds: setting all the ports to the maximum frame size possible took another 20. Without rebooting either the host server or the iSCSI target provider, the data transfer rate went up from 4.5MB/sec to an average of 90MB/sec, peaking at 115MB/sec for smaller copies. This did not wave a magic wand over the corrupted message base, however. For that we had to resort to a better-value one-off payment, this one to Nucleus Technologies for its rather minimalist but nonetheless capable Kernel recovery utility for Exchange (see pcpro.link/258sc2). This tool was able to retrieve data from the affected file, but not without a diverting and very annoying little party trick whereby it doesn't quite tell you clearly that you can't run it on the same server the EDB file is living on.

Instead it throws an obscure error about missing DLLs and invites you to get in touch for a support incident call – but not on Sunday 20 December. The long Christmas break meant that the usual rules were suspended, both

ABOVE Nucleus Technologies' Kernel recovery utility for Exchange is minimalist but capable

“This is where my reputation as a miracle worker was forged”

when it came to the patience of hundreds of email users on Monday 21 December, and the readiness of a beleaguered CIO to work late over the weekend to get them their messages back. So I crowdsourced a Google search (thanks Facebook pals, you know who you are) and we figured out the problem was that Kernel really doesn't play well when run from a server OS – it grew out of the workstation software end of the market instead, and this is where, so far as this client is concerned, my reputation as a miracle worker was forged.

Modest as I am, I wonder how many other hardened Exchange admins would have thought to tackle this crisis by grinding 300GB of data over the LAN to the management PC to employ its agonisingly slow, USB-connected 1TB laptop disk as working space for this recovery utility? Rather than heed the agonising reports of ever-extending progress bars, either in the copy or in the recovery utility, I used the built-in standard iSCSI Initiator utility in Windows 7 Professional to link the Exchange message store's iSCSI container directly to the workstation with the right software environment for Nucleus' utility to complete, without any obscure errors or polite invitations to spend more money by hanging on their support line. Running at that same, impressive 90–115MB/sec, the utility made pretty short work (that is, a few hours) of exporting everything recoverable to PST files.

Although iSCSI may make its connection over the network layer right enough – that's why I became interested in it and why there's such widespread adoption of it – it delivers that network traffic deep within the guts of the storage system, not up among the battlements and defences that now surround the parts facing the internet and other equal-status machines such as servers. Practical understanding of how this counts as an advance, and how it should change your thinking in an emergency, is a vital part of the toolkit of the modern-day systems administrator. But not yet, apparently, in the toolkit of those internet-advertised, pay-per-incident, overseas emergency support operators.

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All data transferred to the datAshur Pro is encrypted in real-time via the built-in hardware encryption chip. The drive automatically locks when unplugged from the host computer and can also be set to lock after a predetermined amount of time when still plugged in.

The datAshur Pro doesn't require any software or drivers to be installed and is compatible with Windows, Mac, Linux, Chrome, Android, thin clients and embedded systems. It delivers drag-and-drop encryption, plug-and-play simplicity and can be used with any software.

The flash drive is bootable and comes in 8GB, 16GB, 32GB and 64GB capacities. It's pending numerous certifications, including FIPS 140-2 Level 3, CESS CPA Foundation Grade and NLNCSA Level 2.

Designed to last for many years, the rugged, extruded aluminium, waterproof casing protects the drive against physical damage, and is IP57 certified. To find out more, visit istorage-uk.com/datashur.php

What IP rating does the iStorage datAshur Pro meet?

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Futures



We explore the trends and technologies that are set to shape the future

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Art and tech meet at the Electronic Superhighway **p129**

Backing up the physical world

History is being scanned in 3D, from sites in war zones to a 126-year-old peanut.

Nicole Kobie reveals why academics are turning to 3D for preservation

What do the at-risk ancient monuments of Syria and the world's oldest ham have in common? They're both being preserved in 3D for future generations to enjoy (if not taste).

The technology isn't new, but smarter and smaller hardware is helping push its use by academics and archivists alike.

Variations of the technology are being used to preserve monuments before they're lost, resurrect those that have already fallen, and let academics, students and museum visitors get their hands on perfect 3D-printed replicas of objects that would be damaged by their touch – including the world's oldest preserved ham from 1902 and a peanut from 1890.

How it works

3D scanning is accomplished either with lasers that take measurements when they bounce off an object, room or monument, a technique called Lidar, or by stitching together layers of 2D photographs, called photogrammetry.

British startup ScanLAB used the Lidar system – a portmanteau of light and radar – to scan an entire gallery of ships at the Science Museum before the models were packed up. It has also scanned tunnels beneath Rome and made replicas of icebergs.

Lidar hardware is also used by Californian non-profit CyArk to

scan monuments such as the Brandenburg Gate in Berlin or helping volunteers in Iraq scan the Ziggurat of Ur. "This technology works by sending out a pulsed laser beam of light and measuring how long it takes for the laser to hit a surface and return," CyArk vice president Elizabeth Lee told *PC Pro*. "Using the sensors in the machine, the scanner is able to calculate individual X, Y and Z co-ordinates for each single point. The machines are capable of doing this several hundreds of thousands of times a second. The result is a 3D cloud of individual data points that can be used to create accurate blueprints of the sites captured, 3D prints, or used to develop virtual experiences such as 3D fly-through animations or virtual reality." Those are then used alongside drone photography, as well as photogrammetry, to create accurate digital models.



ABOVE Lidar has been used to scan historic sites such as the Brandenburg Gate

BELOW Replicas of the Temple of Bel are being constructed in London and New York

Lower costs have helped put this technology into the hands of less-specialist users. Dr Bernard Means, head of Virginia

Commonwealth University's Virtual Curation

Unit, uses a NextEngine Desktop 3D scanner to make scans of objects of historical interest, particularly artefacts from archaeological digs and Native American heritage. This scanner is a camera pointed at a turntable, which costs \$3,000 rather than the \$25,000 such hardware used to fetch. "We usually use eight rotations," he told us. "The rotations are not continuous. Basically, the scanner does one pass, captures details of an object, then rotates, and repeats. The resolution of the scanner is up to 0.05mm, although the actual resolution may vary because of the nature of the object. Shiny or clear things are challenging to scan, as are very dark objects."

Dr Means also has a \$400 handheld scanner that attaches to a tablet such as an iPad, which he can use to scan objects that are too large for the turntable, or are too fragile to make the trip to his office – including the Isle of Wight County Museum's very old ham and preserved peanut, which he decided to scan in person.

■ The point of digital

While it's easy to see the value in scanning immovable monuments in war zones, the value in archiving an old ham may be less clear.

Dr Means notes that neither the peanut or ham can be handled by the general public, but 3D models can be printed to give visitors a hands-on experience – and to create key rings and knick-knacks to sell in the shop.

Aside from 3D-printing models, Dr Means said the museum is hoping to monitor the condition of the ham over time. “Maybe five years from now, you could come back and scan it again and make a direct comparison,” he said. “It’s an advantage over photos... the challenge with using a photograph is that over a five-year period, cameras change, it’s hard to get the lighting exactly the same, and so on. Whereas if we do a 3D scan, you’re capturing the entire object. It doesn’t matter what angle you start at... and you can use software to make a direct alignment and comparison of the two models, so you can very accurately measure whether there’s been any change in the condition of the object.”

■ Preserving the past

3D scanning is being put to more important tasks than measuring a leg of pork. After the onslaught of ISIS, the ancient site of Palmyra and its Temple of Bel is assumed to be entirely destroyed. It’s too late to scan Palmyra with Lidar, but it’s being rebuilt using photogrammetry at the Institute for Digital Archaeology (IDA), using photographs to stitch the site together in such detail that replicas are being built in London and New York.

It’s a great use of 3D technology to put cultural monuments “forever beyond the reach of those who would destroy them”, as the IDA says, but it’s difficult to achieve perfect accuracy with retroactive scans, noted CyArk’s Lee. “The 3D data CyArk collects and archives is more than just a pretty picture,” she said. “We emphasise accurate data that allows for a wealth of possibilities. The data in our archive is accurate enough to be used to generate blueprints of a site or engineering documents that could be used in the event of a reconstruction.” It’s also used for immersive experiences, such as the 3D projections, or shared online.

UNESCO is working with CyArk to scan World Heritage Sites, alongside its separate Project Anqa – phoenix in Arabic – which looks to scan at-risk monuments, often at great danger to the photographers. “CyArk has however recently launched a joint programme with the International Council on Monuments and Sites (ICOMOS) for emergency recording



of sites at high risk in the Middle East called Project Anqa,” Lee said. “This programme is initially focused on Iraq and Syria with the aim to accurately record monuments which are still accessible, although at elevated risk.”

■ Storing the world

But there’s nothing like the real thing – no 3D-printed model will make up for the devastation at Palmyra. “3D models can be very accurate, but may miss key features,” said Dr Means. “Our scanning efforts focus on the surface of an object and miss the interior. CT scans can get more of the internal structure of an object, but are a bit more challenging. However, by creating a 3D model of an object, that model can be handled and replicated repeatedly, reducing the handling of the original and making it last longer.”

Dr Means admits academics argue that 3D models aren’t sufficient, and that “they need to study the real thing”, but he said “things archaeologists do – such as measure

ABOVE Volunteers have scanned the Ziggurat of Ur in Iraq

BELOW Dr Bernard Means scanning the world’s oldest ham



and identify – can be done with digital models.”

Lee said there’s intangible data that can’t be captured in a 3D model – the stories of people who use them or to whom they have cultural importance. “We’ve made a big effort to do video recordings of people talking about the site, or recording music, or even sound from the site because all of those are really important and add to the experience, but it’s not something

you can capture with a laser,” she said.

With that in mind, it’s worth considering digital records not as a replacement but a backup that not only lets us preserve the ghosts of artefacts and monuments, but also allows academics to share them with students and museums with visitors around the world. And make silly souvenirs. Who doesn’t want a key ring of an 1890s peanut, after all? ●

Storing the world’s digital archive

CyArk’s Project Anqa aims to collect and archive more than 500 sites around the world over the next five years – and that means gathering and storing an incredible amount of data. That’s why CyArk has teamed up with Seagate. “On average, each individual site is three terabytes in size – equivalent to 1.3 billion typewritten pages,” said Ulrich Plechschmidt, managing director for cloud systems at Seagate Technology in Europe. “By the end of the project, when all 500 sites have been completed, Seagate will have stored two petabytes of data – the equivalent of 500,000 high-definition movies.”

He added: “When the project first began it was a relatively small but ambitious initiative. However, the CyArk team didn’t necessarily anticipate the enormous

amount of storage they’d need so quickly.”

The data must be protected from the moment it’s collected in the field – often in challenging, dangerous conditions – through to its final storage point. “In the field, the data is first stored on our external hard drives and later delivered to the high-capacity Seagate Server at CyArk’s headquarters in Oakland, California,” he said.

That’s not the data’s final home. CyArk initially planned to store the final data files on USB sticks in a vault – not a wise move given the failure rate of such drives, or the fact CyArk’s headquarters sits on an earthquake fault line. To help ensure the data will be safe, the company hired Iron Mountain to back up the data on tape in a storage facility in a former mine in Pennsylvania.



Q&A Matchmaking in the workplace

Inspired by online dating, Saberr predicts your work performance based on how well you get along with the rest of your team. Founder Alistair Shepherd tells us why it's the future of recruitment

FORGET MYERS-BRIGGS tests: if you want to know how your colleagues think, turn to Saberr. The British startup claims it can predict the performance of your office team based on how well you get along, using an algorithm informed by online dating. We spoke to its founder, Alistair Shepherd, who uses the software to make all his hires – and even spot which startups are about to fail so he can poach their staff, which is how the company picked up its current CTO.

■ What does your system aim to do?

Our software forecasts how teams and individuals will perform based upon their ability to interact with each other. When you work with people who you like and get on well with, your performance is at its best – you use your skills to the best of your ability. But when you work with people who frustrate you and who you don't particularly respect, it's much harder to feel motivated at work.

Personality tests, such as Myers-Briggs, are very interesting, but not particularly useful. You can't forecast performance with that. We look at what really drives a person from a very data-driven perspective.

■ Sounds like online dating.

We did a lot of our early research from online dating. What we're looking at is what makes people click, what makes people like each other? What makes people not like each other? The things that make a good long-term romantic relationship are also the things that make a good long-term friendship, or a good long-term professional relationship – you're able to respect each other under varying degrees of stress over a long period of time. We looked for patterns in the data from online dating to see if that could help us when we were developing our early algorithms.

Of course, we're not trying to foster romantic relationships, because that would land us in a bit of trouble.

■ How do you know that people answer honestly?

When you're using data to try to analyse a person, it's easy to get bad data. To give you a very crude



example, if one of the questions was – and it's not – “are you hard-working?” There's an obvious right answer to that in the workplace. It takes a lot of effort to carefully design a survey.

More interesting is being able to get the same level of accuracy from data that you're producing in your daily life, because that means there's less chance for you to play the system. We're working on things such as analysing your email history to help give you a better assessment.

■ How do you know it works?

The way we [test] it with current clients is, if they're a big company with hundreds of employees, we can go in and look at teams that they've had operating for the past couple of

years, where they've got performance or outcome data. We'll run our analysis and compare which teams we think should have had the highest performance over the past couple of years with the actual outcome data.

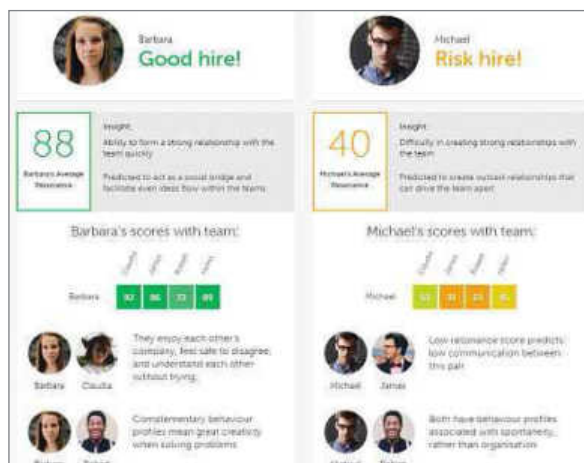
They match up remarkably well. It's surprising because we don't look at people's skills; we don't look at their experience; we don't look at their demographics – all things you consider when you're interviewing somebody. All we look at is the nature of the relationships. It's surprising how predictive that is when it comes to forecasting performance.

■ Has anyone ever refused to answer the questions?

We make the questions in our survey optional. It would be poor practice for an employer to force somebody to do this if they didn't want to. But we try to make it clear that this is for the benefit of the employee, so we get far fewer refusals than I would expect.

There's a big danger that, when you're developing a system such as this, you end up being seen as Big Brother and that it's just another tool to put you in a box. However, I think the real power of data is not giving it to Big Brother, but giving it to you as the employee to help you manage your career better. Which employee doesn't want to be happier at work and have a more successful career? I think we all strive for that. ●

BELOW Saberr's software looks at what factors make a team click or not



Taking aim at smart guns

President Obama says smart guns might have a role to play in reducing shootings. Nicole Kobie investigates

President Obama called for gun-control measures with tears in his eyes, but his words will put smiles on the faces of smart-gun makers.

He asked why the “most technologically advanced nation on Earth” doesn’t use biometrics to secure weapons. “If we can set it up so you can’t unlock your phone unless you’ve got the right fingerprint, why can’t we do the same thing for our guns?” he asked.

Smart guns already exist. Armatix’s iPi pistol will only fire if the user wears a watch with a matching RFID chip, whereas Mossberg’s handgun unlocks via an RFID ring. Identilock and Kodiak have also developed fingerprint scanners.

The appeal of smart guns is clear, said independent security analyst Joseph Steinberg: they reduce the likelihood of people accidentally shooting themselves or others; make it harder for stolen guns to be used; and make it tougher for criminals to take a police officer’s gun. However, they’re held back by politics and technical challenges.

■ Not so smart

Making a reliable smart gun isn’t easy. “There are complexities involved with putting sensitive electronics inside an object that absorbs quite a bit of force,” Steinberg told us. “Biometric authentication technology is imperfect, and electronics crash and malfunction, especially in cold and hot temperatures.”

Steinberg points to one fact: smart guns haven’t been bought by any police departments in the US. “If the professionals don’t trust the weapons to be reliable, why would anyone else?”

That said, certain complaints have been solved. One common query is what happens when the battery fails. Robert McNamara, co-founder of RFID gun safety firm TriggerSmart Technologies, told *PC Pro* that modern designs have a ten-year battery life, and have microcontrollers and LED indicators to warn of low power.



■ Security concerns

It’s reasonable to expect the guns will be hacked. Critics point out that RFID tokens can be stolen, fingerprint authentication on smartphones has been cracked, and guns must be disassembled to be cleaned. “Manufacturers need to show evidence that criminals who steal smart guns cannot modify them to work with the technology removed or disabled,” Steinberg noted.

Moreover, he said there are concerns that the guns may be subject to government tracking or jamming. Sound paranoid? Steinberg says we only need look at the NSA’s record on network hacking: “Are firearms really less worthy of being tracked than telephone records?”

■ Playing politics

Politics also holds back smart guns. Safety measures have been criticised by the National Rifle Association (NRA), following short-lived laws requiring all weapons to be smart.

Ten years ago, New Jersey introduced legislation that would have banned normal guns once smart versions became available, prompting boycotts from the firearms industry.

However, none of this means that smart guns are a bad idea. TriggerSmart’s McNamara said that an intruder won’t have time to hack your gun, saying the aim is to reduce accidental “discharge” while still keeping guns useful for such situations.

Crowdfund this!

Our pick of UK tech projects on Kickstarter and Indiegogo

Hits and misses

A year and a half ago, we started this column to highlight what we considered to be the most interesting, technology-related crowdfunding projects. Here, we take a look back at how those projects have fared and ask if crowdfunding is an effective way to get tech products to market.

Does crowdfunding work? For every Pebble – which raised a huge \$20 million (£14 million) on Kickstarter – there are plenty of failures. Of the 16 projects we’ve picked so far, only four were funded, a hit rate of 25%. That’s better than average: Kickstarter states only 20% of tech projects hit their target.

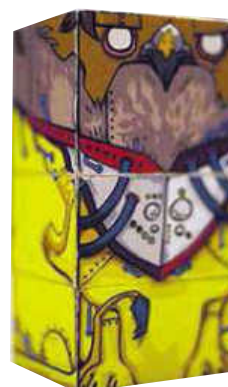
Some were easy wins. The Sinclair ZX Spectrum Vega games machine was 150% funded and the Sense ICON smart bike light quadrupled its goal. Others failed terribly. That includes the Raspitab, a tablet run by a Raspberry Pi, which convinced only 87 backers to part with their cash. Our favourite, SwapBot’s augmented reality toys, earned a third of its \$100,000 goal.

But at least it earned cash. The MySpotIs GPS tracker didn’t win a single backer, while the Openrout Raspberry Pi router took in \$1 and the ExoFingerMouse, a touch scroller for handsets, earned £100.

One project failed with crowdfunding, but still found success. The 3D-printed OwnFone won only 69 backers, earning a fifth of the £200,000 sought – but now has a store in London.

What about the winners? Two have shipped, but the other two of our “successful” picks haven’t, with production delays holding back the Wedg personal cloud and Kibbi smart-home security system.

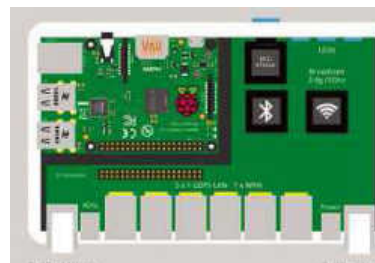
Learn anything? Ideas you love may not have mass appeal, manufacturing hardware is difficult, and there’s something to be said for waiting until tech exists before handing over your credit-card details.



ABOVE We love SwapBot’s augmented-reality toy



ABOVE The OwnFone now has its own shop in London



ABOVE The Raspberry Pi router earned a measly \$1



ABOVE At least the Spectrum Vega beat its funding target



What is... D-Wave 2X?

Google and NASA are using a D-Wave 2X quantum computer that's 100 million times faster than existing top-end machines

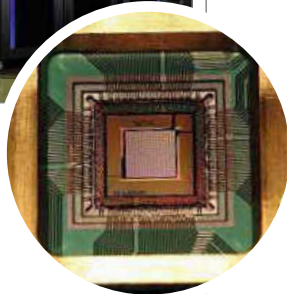
Quantum computing again? Haven't we been hearing about this for years? The idea of

trading bits for qubits – which can be a one, zero or both simultaneously – isn't new. But for the first time, someone's making the concept work on real-world computing problems. Google and NASA have been studying how quantum systems can advance artificial intelligence and machine learning, and solve difficult optimisation problems, using hardware from quantum firm D-Wave. It's the latter challenge, called quantum annealing, that's generating fresh excitement, with the researchers solving a major problem using the D-Wave 2X, which could help bring quantum computing into the mainstream.

So Google didn't make the hardware? No, NASA and Google simply have a standing order with the Canadian company to receive its top-end machines. That's now the 2X, a quantum computer that's 100 million times faster than a normal computer. But using a D-Wave machine isn't as simple as plugging it in and typing queries. The 2X is ten feet tall and must be kept at a chilling -273°C . Aside from a supply of liquid helium to reach such depths of temperature, those hoping to use a quantum machine must work out how to write algorithms and programs that work with the system. That's easier said than done, as NASA notes: "Representing information in qubits allows the information to be processed in ways that have no equivalent in classical computing." We've built the machine, now we need to discover how it works.

We don't know how it works?

Intriguingly, there's long been debate over whether the D-Wave design even qualifies as a quantum computer, although Google's research is being seen as proof that it does use quantum properties to solve problems. One critic, MIT professor Scott Aaronson, has pointed out that the research



reported by Google does show a 100-million-times speed jump, but he argues it's an unfair comparison as it's against a standard computer running an algorithm designed specifically for quantum machines. He claimed better results can still be achieved via "classical" techniques, namely better algorithms on conventional computers.

What could this be used for? If Google and NASA's work bears fruit, this subset of machine learning and AI is ideal for optimisation – simply put, figuring out the best way to do something. For NASA, that could be selecting a flight path to Mars, but it could be applied to anything from drug modelling to cracking encryption, or simply revealing the most efficient train route through Europe for a summer holiday.

When will quantum computers land on our desktops? Google called the results "intriguing and very encouraging," but there are many more problems to solve before it becomes a "practical technology". Even then, it will first find use in labs and industry. We'll likely access such power via companies such as Google, which will offer quantum services the way IBM sells its Watson AI intelligence now. Besides, you haven't got room in your freezer for a D-Wave 2X.

Best of **alphr.com**

Our sister site **Alphr** covers the latest in tech and science – here are the top stories from this month on the innovations that are just over the horizon.

Does the internet make our brains lazy?

Forgotten something? Google it. Lost your way? Open satnav. Does this reliance on technology make our brains lazy? Research suggests we make less of an effort to remember a fact when we know it's available at the touch of a button, a phenomenon dubbed "digital amnesia". However, separate studies suggest this doesn't mean our minds are becoming weaker, but more efficient at choosing what information is worth remembering – why waste brain space on trivia when you can remember something more important? That said, more research is required – it's clear that the internet is changing our brains, but whether it's bad news or not remains to be seen.

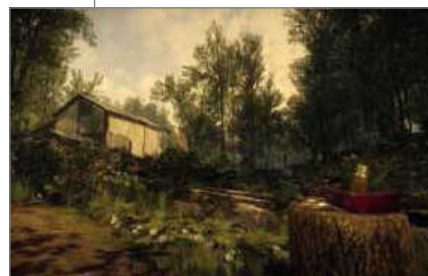
[pcpro.link/258alphr](#)



How real life imitates the games we play

Do you see *Frogger* whenever you try to cross a street, or *Tetris* blocks when packing groceries into your car boot? For many of us, art doesn't imitate life, it's the other way around, altering not reality but how we perceive it – just as the beauty of the English countryside passed us by until Constable painted it. And, like art, games are a cultural medium that help us make sense of a threatening world, according to psychoanalyst Josh Cohen. "Games are interesting in this regard because they're so interested in the undertow of psychic life – violence and aggression, sexuality, greed, rivalry, power," he notes.

[pcpro.link/258alphr2](#)



The lessons of "smart" cities

There's been a noticeable gap between the promise of smart cities and the outcomes, admits head of Nesta UK, Tom Saunders, pointing to a Santander project that installed 10,000 sensors across a city, collecting plenty of data, but not actually improving its operations. Lessons have been learned from such slip-ups, and there's now a host of good ideas to borrow from cities around the world: think smart street lights in Glasgow and clever bins in Barcelona, which raise the alarm when they're full. Such ideas work better than trying to build a totally smart city from the ground up, Saunders noted, adding that any connected city must represent what citizens actually need and want, rather than merely what the data scientists find exciting.

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Geek Day Out: Electronic Superhighway

Art and technology converge in this retrospective art exhibition at the Whitechapel Gallery in London



ABOVE Rachel Maclean's 2013 video *Germs*

LEFT Rafael Lozano-Hemmer's *Surface Tension*

RIGHT Eduardo Kac's *Tesão (Horny)*, 1985



London's famous Whitechapel Gallery is highlighting internet-themed art with an exhibition called Electronic Superhighway that brings together 100 pieces from the past 50 years.

"How have evolving technological processes affected our sense of reality? How have they altered the way in which we attribute value to objects, understand human relationships and legal processes? These are but a few of the questions explored in the exhibition," notes curator Omar Kholeif in the introduction to the show.

"The project examines artistic processes and formations that have emerged as a direct result of changing technological conditions," he continues, adding that "it questions how constantly emerging technologies might lead us to a sense of a possible future"

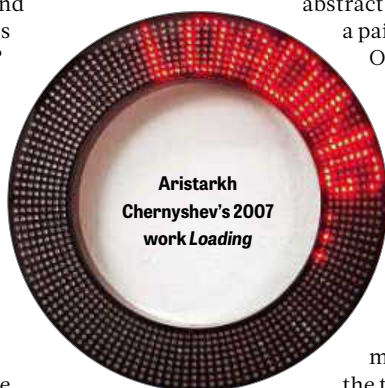
The collection includes a stop-off in 1974 with Korean-American video-art pioneer Nam June Paik, who coined the term "electronic

superhighway"; in 1999 with the Rhizome group's browser-based works; and in 2014 with Amalia Ulman's four-month Instagram project examining social media's influence on attitudes towards the female body. Highlights of the exhibition include Paik's *Internet Dream*, a huge "video sculpture" made up of 52 monitors showing abstract images, and a painting from

Oliver Laric's *Versions* project, highlighting issues around image manipulation by poking fun at a Photoshopped missile launch image from Iran.

While the names of the artists may be unfamiliar, the topics won't be – whether it's considering

how social media affects how we see the world, examining the impact of handing communications to massive private corporations, or the ongoing surveillance debate. "The context of these debates resists easy synthesis and summary," said Kholeif. "For every piece of utopic potential there is a counter-form dystopic argument."



“The show asks how constantly emerging technologies might lead us to a sense of a possible future”

And that offers up material for artists to work with, he noted.

The exhibition is timed to mark the 50th anniversary of the start of a key group of artists, featuring documents from the archives of Experiments in Art and Technology (EAT), a collective that included John Cage and was co-founded by Bell Labs engineer Billy Klüver. "Its beginnings were first presented over the course of nine evenings in 1966, right before

the ARPANET papers [the starting point of the internet] were to be published, in what was one of the first major public collaborations

between artists and engineers who were working together to push technology to its limits, to consider not only what it could do to art, but more importantly, how artists could reshape and reform the essence of technology through their artistic processes," said Kholeif.

The Electronic Superhighway exhibition runs from 29 January until 15 May at the Whitechapel Gallery in London. Tickets cost £13.50 and more information is available at whitechapelgallery.org. ●



So what if Microsoft and Apple weren't at CES: it's the small stands that matter, says **Jon Honeyball**

I've returned from the Consumer Electronics Show in Las Vegas complete with the usual annual flu. It seems you can't pack nigh-on 200,000 people into a few enormous convention halls without bugs spreading like wildfire. It really does belie the claim that what happens in Vegas stays in Vegas. The mass illness sweeping the tech world at the moment is a predictable and unwelcome side effect of the world's biggest, craziest consumer electronics show.

Flu makes you grumpy and maybe that's why there is so much press this year about how CES has apparently lost its mojo. Microsoft wasn't there, although it's hard to see what it had to show – Windows Mobile, anyone? Apple wasn't there, but it hasn't been for years, much preferring to orchestrate its own media machinery in a fine-tuned dance with the favoured few, myself excepted.

There were the usual monstrous stands from Samsung, Sony and LG, all of which showed just how seriously they take the event. But maybe it was the lack of anything spectacularly new that riled news journalists. There was a lot in Vegas that was almost-ready, but not quite. VR is a great example – many vendors showing it, all of it not quite good enough, with no compelling business case for Joe Public.

It doesn't help that the press events get more and more unpleasant to attend each year – a two-hour wait for the Samsung briefing being one low-light. Then there's the frenzy of the evening press events such as Pepcom and CES Unveiled, where you too can have a product removed from your hands by a teenager with a camera because "I have to go live with this on my blog right now".

But I say pish and tish to the news journos. CES is not about news, it's about business. I suspect that huge numbers of deals are done there, simply because it's an ideal place for everyone to get together, stare one another in the eyes and sign business contracts. It's an opportunity to meet up with friends and colleagues you haven't seen since last year's event. It's a time to go looking around the smaller displays for the really interesting bits, the nuggets that make you pause and think.

I know full well what it's like to attend one

of these large trade shows as an exhibitor. Since starting our high-end food brand **welovemanfood.com** three years ago – with great success, including a BBC programme about us – we have to attend the appropriate trade shows. These are unbelievably stressful, tiring and hard work. Have we brought everything we need? Do we have enough samples? Am I wearing the right shoes to be able to stand for more than 12 hours a day? Are my facial muscles toned enough to keep smiling? Is my temper under sufficient self-control not to say something unpleasant to a rude person who pulls a face at our hard work, hopes and aspirations?

The real heroes of CES aren't the big stands, but the smaller ones tucked away at the edges. I applaud their sheer guts to fly halfway around the world to represent their company and staff, and to try to do business. That's what it's about – business. I spent time at CES with my good friends from Naim Audio, who launched their new Mu-so Qb wireless speaker (*winner of a Top Picks award in PC Pro's*

CES coverage on p28). It's a delight to see and operate, but for my pals on the stand every moment of every day was focused on business – seeing customers, introducing them to the product, getting feedback and ideas, and chewing the cud.

In a few weeks, my partner and I are off to Belgium for a major food fair with our brand: new faces to meet, potential customers to sell to, and all based in a language that is not our

first. It will be tiring beyond belief, but it has to be done. That's why I make sure I spend what time I can at the smaller booths at CES.

Yes, many of them display yet another 200 designs of iPhone cases, but then you come across something truly interesting. Something fresh that might just get traction to hit a wider audience. Always be polite, show interest and exchange business cards. You have no idea you who might bump into in the lift, and a few days later have a conversation that leads to invocable work.

That's the brilliance of CES. Almost 200,000 people who have travelled from afar, pumped with the passion and determination to get themselves and their products noticed. So what if a big name wasn't there? That's not the point of the place. If only I could do it without ending up bedridden afterwards. Maybe that's a product idea for someone at CES 2017? I'd buy it.

■ **Jon Honeyball is contributing editor to PC Pro. He finds knee-length cowboy boots to be essential to the art of standing up, stationary, for a day.**

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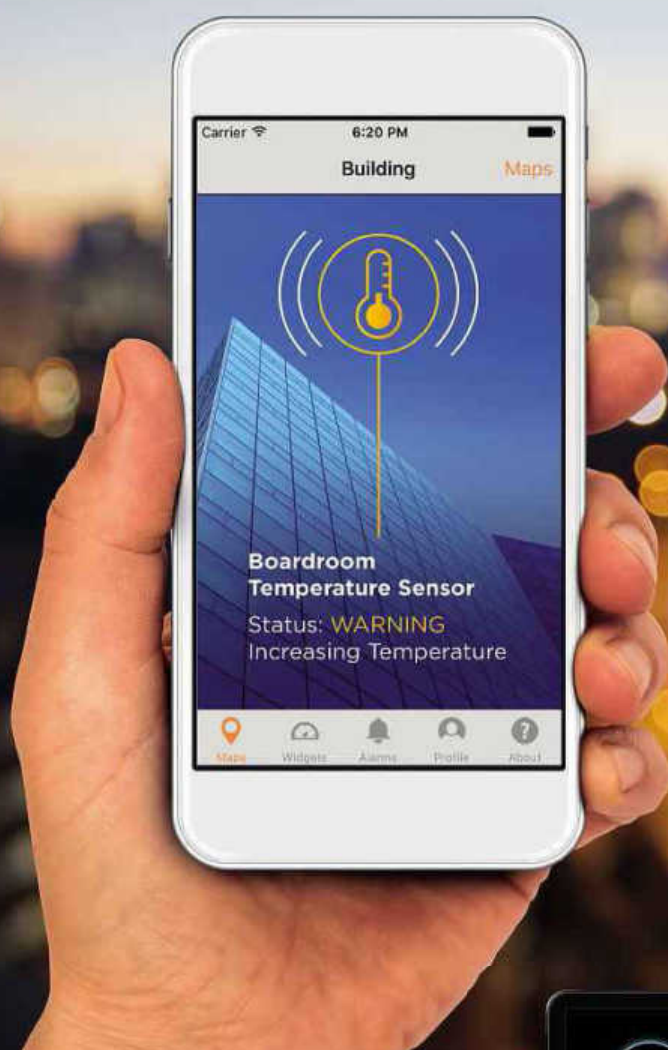
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